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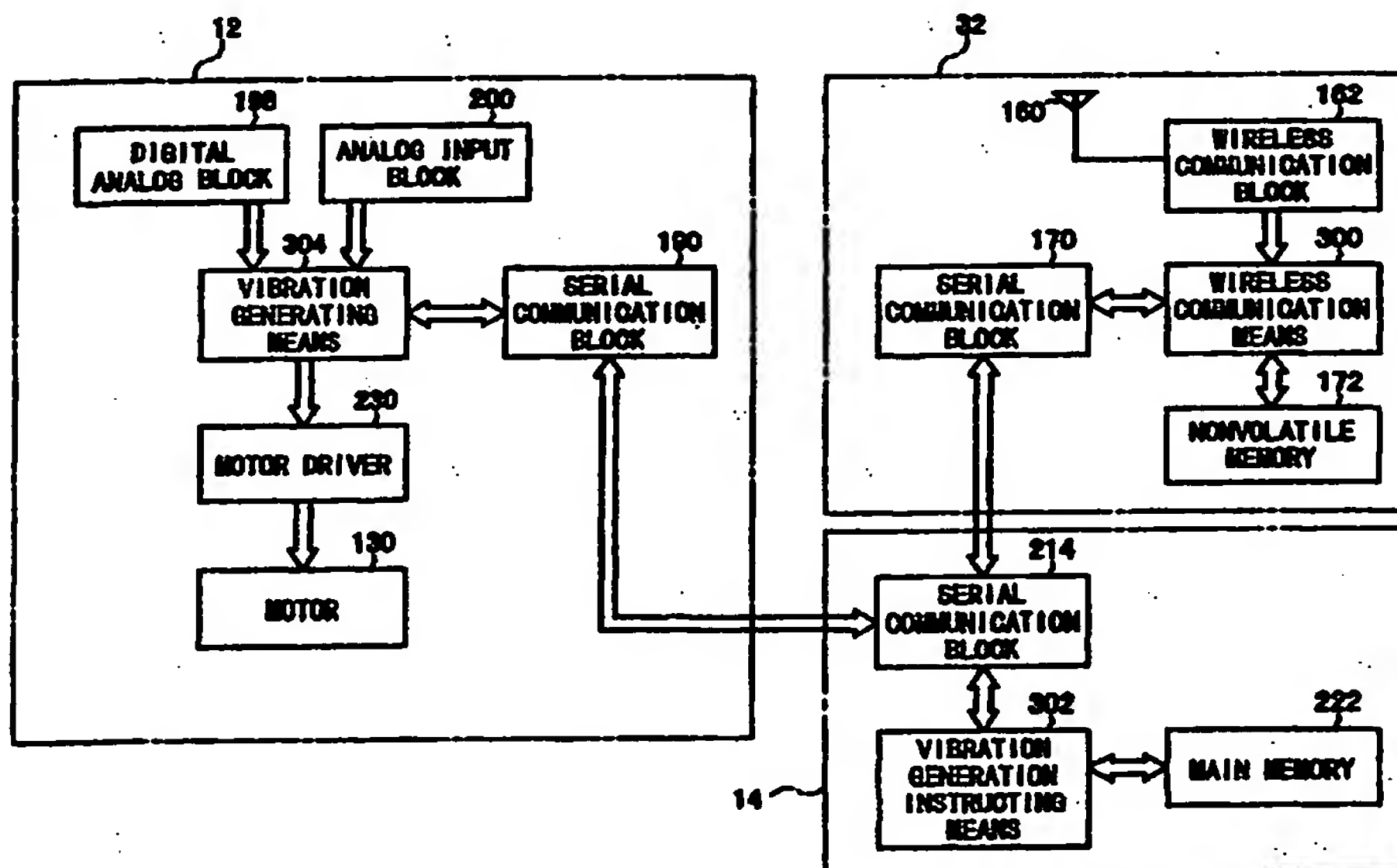
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(57) Abstract

An entertainment system has an entertainment apparatus (14) for executing various programs, at least one manual controller (12) connected to the entertainment apparatus (14) for entering manual control requests from the user into the entertainment apparatus (14), and a portable information terminal (32) for receiving a wireless signal and sending information to and receiving information from at least the entertainment apparatus (14). The manual controller (12) having motors (130) for applying vibrations to the user in response to an external request. The entertainment apparatus (14) has a vibration generation instructing unit (302) for outputting an instruction to generate vibrations to the manual controller (12) in response to the reception of a wireless signal by the portable information terminal (32).

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- 1 -

DESCRIPTION

ENTERTAINMENT SYSTEM AND RECORDING MEDIUM

5 Technical Field

10 The present invention relates to an entertainment system comprising an entertainment apparatus for executing various programs, at least one manual controller for entering control requests from the user into the entertainment apparatus, and a portable information terminal capable of receiving wireless signals and sending information to and receiving information from at least the entertainment apparatus, and a recording medium which stores programs to be downloaded into the entertainment apparatus and the portable information terminal.

15

Background Art

Information apparatus (entertainment systems) such as entertainment apparatus including video game machines display images of a game stored in a recording medium such as a CD-ROM or the like on the display screen of a television receiver as the game proceeds in response to commands from a manual controller operated by the game player.

20

25 The entertainment apparatus and the manual controller in the entertainment system are usually connected to each other by a serial interface. When a clock signal is sent from the entertainment apparatus to the manual controller, the manual controller sends key switch information corre-

- 2 -

sponding to a control action entered by the user in synchronism with the clock signal.

Recently, there has been developed and used an entertainment system in which a manual controller has a vibration generator for applying vibrations to the user in response to a request from an external source (e.g., the entertainment apparatus). While the game is in progress, for example, the vibration generator imparts various types of vibrations to the user in response to control actions entered by the user.

There have been proposed portable information terminals capable of receiving various items of information transmitted from wireless paging systems and wireless broadcasting systems. Such portable information terminals include pagers, for example, and are capable of receiving information distribution services for distributing information including weather information, event information, etc.

Heretofore, portable information terminals such as pagers have been independent devices, and have not been used connected to entertainment apparatus.

Some existing portable personal computers incorporate portable information terminals. Those portable information terminals indicate the reception of a wireless signal by displaying a message on a display screen or generating a sound, but do not have any tactile means for indicating the reception of a wireless signal to the user.

There has not been available a computer system in which a plurality of portable information terminals can be connected to a single entertainment apparatus and simultane-

- 3 -

ously used by a plurality of users. Even if a plurality of portable information terminals were connected to a single entertainment apparatus, there would be no function available for selectively transmitting information to the user corresponding to data received by a portable information terminal.

Disclosure of Invention

It is therefore an object of the present invention to provide an entertainment system in which a portable information terminal can be connected to an entertainment apparatus and used by a user, and the reception of a signal by the portable information terminal can be transferred to the user through a tactile sensation.

Another object of the present invention is to provide an entertainment system in which the properties (intensity, frequency, and vibration generator type) of vibrations imparted to a user can be varied depending on a signal received by a portable information terminal, so that the user can recognize the received signal through a tactile sensation.

Still another object of the present invention is to provide an entertainment system in which a plurality of portable information terminals can be connected to a single entertainment apparatus and used by respective users, and information can be transmitted selectively to the user corresponding to data received by a portable information terminal.

- 4 -

Yet another object of the present invention is to provide a recording medium which stores a program for allowing a portable information terminal to be connected to an entertainment apparatus and used by a user, and also allowing a signal received by the portable information terminal to be transmitted to the user through a tactile sensation.

Yet still another object of the present invention is to provide a recording medium which stores a program for allowing the properties (intensity, frequency, and vibration generator type) of vibrations imparted to a user to be varied depending on a signal received by a portable information terminal, so that the user can recognize the received signal through a tactile sensation.

A further object of the present invention is to provide a recording medium which stores a program for allowing a plurality of portable information terminals to be connected to a single entertainment apparatus and used by respective users, and also allowing information to be transmitted selectively to the user corresponding to data received by a portable information terminal.

According to the present invention, an entertainment system comprises an entertainment apparatus for executing various programs, at least one manual controller connected to the entertainment apparatus for entering manual control requests from the user into the entertainment apparatus, and a portable information terminal for receiving a wireless signal and sending information to and receiving information from at least the entertainment apparatus, the manual con-

- 5 -

troller having vibration generating means for applying vibrations to the user in response to an external request, the entertainment apparatus having vibration generation instructing means for outputting an instruction to generate vibrations to the manual controller in response to the reception of a wireless signal by the portable information terminal.

With the above arrangement, the portable information terminal can be connected to the entertainment apparatus and used by the user, and the reception of a signal by the portable information terminal can be transferred to the user through a tactile sensation.

As a result, the user can receive specific or arbitrary information by way of a wireless signal while viewing the display screen of a television receiver connected to the entertainment system. Since the manual controller vibrates when the portable information terminal receives the information, the user can recognize that the specific or arbitrary information has been received by sensing the vibrations of the manual controller.

If the user is playing a competition game together with another game player at a distance via the Internet, then a result produced by an action of the user can be transmitted with vibrations to the user, so that the game can be played with a highly realistic effect.

The entertainment apparatus may have monitoring means for monitoring the reception of data by the portable information terminal, the vibration generation instructing means

- 6 -

comprising means for outputting an instruction to generate vibrations to the manual controller in response to the reception of data as detected by the monitoring means.

The portable information terminal may have interrupt
5 signal generating means for generating an interrupt signal in response to the reception of the wireless signal, the vibration generation instructing means comprising means for outputting an instruction to generate vibrations to the manual controller in response to the interrupt signal.

10 The entertainment apparatus may have selecting means for selecting at least one of a plurality of manual controllers connected to the entertainment apparatus depending on the content of a wireless signal received by the portable information terminal, the vibration generation instructing
15 means comprising means for outputting an instruction to generate vibrations to the selected one of the manual controllers.

In such an arrangement, of the manual controllers, the manual controller corresponding to the content of the wireless signal received by the portable information terminal is
20 vibrated. Therefore, when a plurality of users or game players handling respective manual controllers connected to one entertainment apparatus are retrieving various items of information or playing a competition game, the reception of
25 a wireless signal by the portable information terminal is transmitted as vibrations to one of the users which corresponds to the content of the wireless signal. A plurality of portable information terminals and a plurality of manual

- 7 -

controllers may be connected to the entertainment apparatus, and the vibration generation instructing means may comprise means for outputting an instruction to generate vibrations to the manual controller corresponding to the portable information terminal which has received the wireless signal.

Therefore, a plurality of portable information terminals can be connected to a single entertainment apparatus and used by respective users, and information can be transmitted selectively to the user corresponding to data received by a portable information terminal.

The vibration generation instructing means may comprise means for outputting an instruction to generate vibrations to one of the manual controllers which is physically closest to the portable information terminal which has received the wireless signal.

Alternatively, the vibration generation instructing means may comprise means for outputting an instruction to generate vibrations to one of the manual controllers which is logically associated with the portable information terminal which has received the wireless signal.

The instruction to generate vibrations outputted from the vibration generation instructing means may include a property of the vibrations depending on the signal received by the portable information terminal.

In the entertainment system, the properties (intensity, frequency, and vibration generator type) of vibrations imparted to a user can be varied depending on a signal received by a portable information terminal, so that the user

- 8 -

can recognize the received signal through a tactile sensation.

According to the present invention, a recording medium stores a program and data used by an entertainment system comprising an entertainment apparatus for executing various programs, at least one manual controller connected to the entertainment apparatus for entering manual control requests from the user into the entertainment apparatus, and a portable information terminal for receiving a wireless signal and sending information to and receiving information from at least the entertainment apparatus, the manual controller having vibration generating means for applying vibrations to the user in response to an external request, the program having the step of outputting an instruction to generate vibrations to the manual controller in response to the reception of a wireless signal by the portable information terminal.

With the recording medium storing the above program, the portable information terminal can be connected to the entertainment apparatus and used by the user, and a signal received by the portable information terminal can be transmitted to the user through a tactile sensation.

The program may further comprise the step of monitoring the reception of data by the portable information terminal, the step of outputting an instruction comprising the step of outputting an instruction to generate vibrations to the manual controller in response to the reception of data as detected by the monitoring step.

- 9 -

The program may further comprise the step of generating an interrupt signal from the portable information terminal in response to the reception of the wireless signal, the step of generating an instruction comprising the step of outputting an instruction to generate vibrations to the manual controller in response to the interrupt signal.

The program may further comprise the step of selecting at least one of a plurality of manual controllers connected to the entertainment apparatus depending on the content of a wireless signal received by the portable information terminal, the step of generating an instruction comprising the step of outputting an instruction to generate vibrations to the selected one of the manual controllers.

A plurality of portable information terminals and a plurality of manual controllers may be connected to the entertainment apparatus, the step of generating an instruction comprising the step of outputting an instruction to generate vibrations to the manual controller corresponding to the portable information terminal which has received the wireless signal.

The step of generating an instruction may comprise the step of outputting an instruction to generate vibrations to one of the manual controllers which is physically closest to the portable information terminal which has received the wireless signal.

The step of generating an instruction may comprise the step of outputting an instruction to generate vibrations to one of the manual controllers which is logically associated

- 10 -

with the portable information terminal which has received the wireless signal.

5 The instruction to generate vibrations outputted in the step of generating an instruction may include a property of the vibrations depending on the signal received by the portable information terminal.

10 The above and other objects, features, and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings in which preferred embodiments of the present invention are shown by way of illustrative example.

Brief Description of Drawings

15 FIG. 1 is a plan view of an entertainment system according to the present invention;

FIG. 2 is a rear elevational view of an entertainment apparatus of the entertainment system, showing slots thereof;

20 FIG. 3 is a perspective view of the entertainment apparatus;

FIG. 4 is a plan view of a portable information terminal of the entertainment system;

FIG. 5 is a perspective view of the portable information terminal;

25 FIG. 6 is a perspective view of the portable information terminal with a lid being open;

FIG. 7 is a front elevational view of the portable information terminal;

- 11 -

FIG. 8 is a perspective view of a manual controller;

FIG. 9 is a plan view of the manual controller;

FIG. 10 is a rear elevational view of the manual controller;

5 FIG. 11 is a front elevational view of the manual controller;

FIG. 12 is a perspective view showing the manner in which the manual controller is used;

10 FIG. 13 is a bottom view, partly broken away, of the manual controller, showing vibration imparting mechanisms disposed respectively in first and second grips;

FIG. 14 is a fragmentary exploded perspective view of the manual controller, showing one of the vibration imparting mechanisms;

15 FIG. 15 is a fragmentary perspective view of the manual controller with the vibration imparting mechanism installed therein;

20 FIG. 16 is a block diagram of hardware layers and software layers of the portable information terminal, the manual controller, and the entertainment apparatus;

FIG. 17 is a block diagram of the hardware layer of the portable information terminal;

FIG. 18 is a block diagram of the hardware layer of the manual controller;

25 FIG. 19 is a block diagram of the hardware layer of the portable information terminal;

FIG. 20 is a block diagram of components for carrying out bidirectional serial communications between the manual

- 12 -

controller and the entertainment apparatus;

FIG. 21 is a functional block diagram of the entertainment system according to the present invention;

5 FIG. 22 is a functional block diagram of a wireless communication means of the portable information terminal;

FIG. 23A is a diagram of a first type of received data;

FIG. 23B is a diagram of a second type of received data;

FIG. 23C is a diagram of a third type of received data;

10 FIG. 23D is a diagram of a fourth type of received data;

FIG. 24 is a block diagram showing a first mode of use of the portable information terminal, the manual controller, and the entertainment apparatus;

15 FIG. 25 is a block diagram showing a second mode of use of the portable information terminal, the manual controller, and the entertainment apparatus;

20 FIG. 26 is a block diagram showing a third mode of use of the portable information terminal, the manual controller, and the entertainment apparatus;

FIG. 27 is a block diagram showing a fourth mode of use of the portable information terminal, the manual controller, and the entertainment apparatus;

25 FIG. 28 is a functional block diagram of a vibration generation instructing means of the entertainment apparatus;

FIG. 29 is a diagram showing details of a user information table;

FIG. 30 is a diagram showing details of a terminal in-

- 13 -

formation table;

FIG. 31 is a functional block diagram of a vibration generating means of the manual controller;

FIG. 32 is a flowchart of a processing sequence of a wireless communication block based on the first example of received data;

FIG. 33 is a flowchart of a processing sequence of a wireless communication block based on the second through fourth examples of received data;

FIG. 34 is a flowchart of a processing sequence of the wireless communication means of the portable information terminal;

FIGS. 35 and 36 are a flowchart of a processing sequence of the vibration generation instructing means of the entertainment apparatus;

FIG. 37 is a diagram showing details of a vibration information table;

FIG. 38 is a flowchart of a processing sequence of the vibration generating means of the manual controller;

FIG. 39 is a functional block diagram of a modified wireless communication means;

FIG. 40 is a functional block diagram of a modified vibration generation instructing means;

FIG. 41 is a flowchart of a processing sequence of the modified wireless communication means; and

FIGS. 42 and 43 are a flowchart of a processing sequence of the modified vibration generation instructing means.

- 14 -

Best Mode for Carrying Out the Invention

An entertainment system according to the present invention will be described below with reference to FIGS. 1 through 43.

5 As shown in FIG. 1, the entertainment system, generally denoted by 10, according to the present invention has an entertainment apparatus 14 to which a manual controller 12 is detachably connected.

10 The entertainment apparatus 14 reads a program and data recorded in an optical disk D (see FIG. 19), for example, and executes a game, for example, based on the program depending on commands from the user, e.g., the game player. The execution of the game mainly represents controlling the progress of the game and the display of images and the generation of sounds.

15

The entertainment apparatus 14 has a rectangular casing 16 which houses a disk loading unit 18 substantially centrally therein for loading an optical disk such as a CD-ROM or the like as a recording medium for supplying an application program recorded therein. The casing 16 supports a reset switch 20 for resetting a program which is being presently executed, a power supply switch 22, a disk control switch 24 for controlling the loading of the optical disk, and two slots 26A, 26B.

20

25 The entertainment apparatus 14 may be supplied with the application program via a communication link, rather than being supplied from the optical disk as the recording medium.

- 15 -

The entertainment system 10 also includes a manual controller 12 for supplying user's commands to the entertainment apparatus 14.

Two manual controllers 12 may be connected respectively
5 to the slots 26A, 26B to allow two users or game players to play a competition game, for example. A memory card and a portable information terminal 32 (see FIG. 4) which have conventionally been used may also be inserted into the slots 26A, 26B. While the two slots 26A, 26B are shown in FIG. 1,
10 the entertainment apparatus 14 may have more or less than two slots.

The manual controller 12 has first and second control pads 40, 42, third and fourth control pads 44, 46, a starter button 48, and a selector button 50. The manual controller
15 12 also has a vibration generating device disposed therein for generating and imparting vibrations to the manual controller 12. Details of the manual controller 12 will be described below later on.

FIG. 2 shows the slots 26A, 26B which are defined in a
20 front panel of the casing 16 of the entertainment apparatus 14.

Each of the slots 26A, 26B has upper and lower units. Specifically, the slots 26A, 26B have respective memory card insertion units 60A, 60B as their upper units for inserting
25 the memory card or the portable information terminal 32 therein and respective controller connectors (jacks) 64A, 64B as their lower units for connection to a connection terminal 62 (connector, see FIG. 1) of the manual controller

- 16 -

12.

The memory card insertion units 60A, 60B have respective insertion holes (slots) that are of a horizontally elongate rectangular shape. These insertion slots have lower opposite corners round in contrast to upper opposite corners thereof so that the memory card and the portable information terminal 32 will not be inserted into the memory card insertion units 60A, 60B in the wrong orientation. The memory card insertion units 60A, 60B also have shutters for protecting connection terminals disposed therein for electric connection.

The controller connectors 64A, 64B also have respective insertion holes (slots) that are of a horizontally elongate rectangular shape. These insertion slots have lower opposite corners round in contrast to upper opposite corners thereof so that the connector terminal 62 of the manual controller 12 will not be connected to the controller connectors 64A, 64B in the wrong orientation. The insertion holes of the controller connectors 64A, 64B are different in shape from the insertion holes of the memory card insertion units 60A, 60B so that the memory card and the portable information terminal 32 will not be inserted into the insertion holes of the controller connectors 64A, 64B.

In FIG. 3, the portable information terminal 32 is inserted in the memory card insertion unit 60A in the slot 26A which is defined in the front panel of the entertainment apparatus 14.

The portable information terminal 32 can be used as a

- 17 -

memory card inherent in each of a plurality of manual controllers 12 connected to the entertainment apparatus 14. For example, if two users or game players play a game on the entertainment system 10, then two portable information terminals 32 record respective game results of the game players.

As shown in FIGS. 4 through 7, the portable information terminal 32 has a housing 70 which supports a manual control pad 76 having one or more direction buttons 72 and a decision button 74 for entering events and making various selections, a display unit 78 comprising a liquid crystal display (LCD) unit or the like, and a window 80 for wireless communication via infrared radiation, an antenna, or the like.

The housing 70 comprises an upper shell 70a and a lower shell 70b, and houses a board 82 which supports memory devices, etc. thereon. The housing 70 is shaped so as to be insertable into either one of the slots 26A, 26B in the casing 16 of the entertainment apparatus 14. The housing 70 has a connector 84 on the side of one end thereof which includes a rectangular window.

The window 80 is mounted on a substantially semicircular end of the housing 70 remote from the connector 84. The display unit 78 occupies a substantially half area of the upper shell 70a of the housing 70, and is positioned near the window 80.

The manual control pad 76 occupies the other substantially half area of the upper shell 70a, and is positioned remotely from the window 80. The manual control pad 76 com-

- 18 -

prises a substantially square lid 86 that is angularly movably supported on the housing 70 and supports thereon the direction buttons 72 and the decision button 74, and switch pressers 88, 90 positioned in an area of the housing 70 which can be opened and closed by the lid 86.

The direction buttons 72 and the decision button 74 extend through the lid 86 from its upper surface to its lower surface. The direction buttons 72 and the decision button 74 are supported on the lid 86 for movement into and out of the upper surface of the lid 86.

The switch pressers 88, 90 have respective pressing elements supported on the housing 70 for movement into and out of the upper surface of the housing 70. When one of the pressing elements is pressed from above, it presses a corresponding a pressure switch such as a diaphragm switch, for example, mounted on the board 82 in the housing 70.

With the lid 86 closed, the switch pressers 88, 90 are held in vertical alignment with the direction buttons 72 and the decision button 74, respectively. Therefore, while the lid 86 is being closed over the housing 70, when the direction buttons 72 and the decision button 74 are pressed from above into the upper surface of the lid 86, the direction buttons 72 and the decision button 74 cause the pressing elements of the corresponding switch pressers 88, 90 to press corresponding pressure switches in the housing 70.

As shown in FIG. 7, power and signal terminals 92 are mounted on the board 84 and disposed in the window of the connector 84.

- 19 -

The connector 84 has a shape and dimensions that are identical to those of the memory card used in the entertainment apparatus 14.

5 The manual controller 12 will be described below with reference to FIGS. 8 through 15. As shown in FIG. 8, the manual controller 12 has a housing 104 comprising an upper member 100 and a lower member 102 which are mated and joined to each other by fasteners such as screws. As shown in
10 FIGS. 8 and 9, a pair of first and second grips 106, 108 projects from one side of respective opposite ends of the housing 104. The first and second grips 106, 108 are shaped so as to be gripped by the palms of left and right hands of the user or game player when the manual controller 12 is connected to the entertainment apparatus 14 and information
15 retrieval is carried out or the game is played thereby, for example.

The first and second grips 106, 108 are progressively spaced away from each other toward their distal ends and inclined downwardly of the housing 104. To allow the game
20 player to grip the first and second grips 106, 108 comfortably for a long period of time, the first and second grips 106, 108 are tapered from their joint with the housing 104 toward their distal ends, and have arcuate outer peripheral surfaces and arcuate distal end surfaces.

25 As shown in FIGS. 8 and 9, the manual controller 12 has a first control pad 40 disposed on one end of the housing 104 and comprising first through fourth pressable control members 110a, 110b, 110c, 110d. The first through fourth

- 20 -

pressable control members 110a, 110b, 110c, 110d project on an upper surface of the housing 104 and are arranged in a crisscross pattern.

5 The first control pad 40 includes switch elements as signal input elements associated respectively with the first through fourth pressable control members 110a, 110b, 110c, 110d. The first control pad 40 functions as a directional controller for controlling the direction of movement of a displayed game character, for example. When the game player
10 selectively presses the first through fourth pressable control members 110a, 110b, 110c, 110d to turn on or off the switch elements associated respectively with the first through fourth pressable control members 110a, 110b, 110c, 110d, the displayed game character moves in the direction
15 corresponding to the pressed one of the first through fourth pressable control members 110a, 110b, 110c, 110d.

As shown in FIGS. 8 and 9, the manual controller 12 also has a second control pad 42 disposed on the other end of the housing 104 and comprising first through fourth press-
20 able control members 112a, 112b, 112c, 112d. The first through fourth pressable control members 112a, 112b, 112c, 112d project on the upper surface of the housing 104 and are arranged in a crisscross pattern.

The first through fourth pressable control members
25 112a, 112b, 112c, 112d are constructed as independent members, and associated with respective switch elements disposed in the second control pad 42. The second control pad 42 serves as a function setting/performing unit for setting

- 21 -

functions for a displayed game character assigned to the pressable control members 112a - 112d or performing functions of a displayed game character when the switch elements associated with the pressable control members 112a - 112d are turned on.

The manual controller 12 also has third and fourth control pads 44, 46 disposed on a side of the housing 104 remote from the first and second grips 106, 108 and positioned respectively at the opposite ends of the housing 104. As shown in FIG. 11, the third and fourth control pads 44, 46 have respective first and second pressable control members 114a, 114b and 116a, 116b and respective switch elements associated respectively with the pressable control members 114a, 114b and 116a, 116b.

The third and fourth control pads 44, 46 serve as respective function setting/performing units for setting functions for a displayed game character assigned to the pressable control members 114a, 114b and 116a, 116b or performing functions of a displayed game character when the switch elements associated with the pressable control members 114a, 114b and 116a, 116b are turned on.

As shown in FIGS. 8 and 9, the manual controller 12 also has fifth and sixth control pads 118, 120 disposed respectively at confronting corners defined between the housing 104 and the proximal ends of the first and second grips 106, 108 which are joined to the housing 104.

The fifth and sixth control pads 118, 120 have respective rotatable control members 122 rotatable 360° about con-

- 22 -

trol shafts thereof, and respective signal input elements such as variable resistors or the like which are operable by the respective rotatable control members 122. Specifically, the rotatable control members 122 are mounted on tip ends of the control shafts that are normally urged to return to their neutral positions by biasing members, and can be rotated 360° about the axes of the control shafts.

The fifth and sixth control pads 118, 120 can move a displayed character while rotating the same or while changing its speed, and can make an analog-like action such as to change the form of a displayed character, when the game player rotates the rotatable control members 122.

Therefore, the fifth and sixth control pads 118, 120 are used as a control unit for entering command signals for a displayed character to perform the above movement or action.

As shown in FIGS. 8 and 9, the manual controller 12 has a start switch 48 and a selection switch 50 that are disposed in parallel positions between the first control pad 40 and the second control pad 42 on the upper surface of the housing 104. The start switch 48 starts the game when pressed, and the selection switch 50 selects a difficulty level of the game.

The manual controller 12 also has a mode selection switch 124 and a mode indicator 126 that are disposed between the fifth and sixth control pads 118, 120 on the upper surface of the housing 104. The mode selection switch 124 selects a control mode of the fifth and sixth control pads

- 23 -

118, 120 when pressed, and the mode indicator 126 indicates a selected control mode of the fifth and sixth control pads 118, 120. The mode indicator 126 comprises a light-emitting element such as an LED or the like.

5 When the mode selection switch 124 is pressed, it can select a control mode for allowing a command signal to be inputted from the fifth and sixth control pads 118, 120 or a control mode for inhibiting a command signal from being inputted from the fifth and sixth control pads 118, 120.

10 When the mode selection switch 124 is pressed, it can also select a control mode for allowing a command signal to be inputted from the fifth and sixth control pads 118, 120 and selecting the function of the first through fourth
15 pressable control members 112a, 112b, 112c, 112d of the second control pad 42 or the function of the pressable control members 114a, 114b and 116a, 116b of the third and fourth control pads 44, 46. Depending on the control mode selected by the mode selection switch 124, the mode indicator 126 flickers and changes its indication light.

20 As shown in FIG. 12, the first and second grips 106, 108 projecting from the housing 104 are gripped respectively by the palms of the hands of the game player. The housing 104 is not required to be supported by fingers, and the manual controller 12 can be held by the hands while at least
25 six out of the ten fingers of the hands can freely be moved.

As shown in FIG. 12, when the first and second grips 106, 108 are gripped respectively by the palms of the hands of the game player, the thumbs Rf1, Lf1 of the right and

- 24 -

left hands can extend over the rotatable control members 122 of the fifth and sixth control pads 118, 120, the first through fourth pressable control members 110a - 110d of the first control pad 40, and the first through fourth pressable control members 112a - 112d of the second control pad 42, and can selectively press the rotatable control members 122, the pressable control members 110a - 110d, and the pressable control members 112a - 112d.

Since the rotatable control members 122 of the fifth and sixth control pads 118, 120 are positioned in confronting relation to the proximal ends of the first and second grips 106, 108 which are joined to the housing 104, when the first and second grips 106, 108 are gripped by the left and right hands, the rotatable control members 122 are positioned most closely to the thumbs Rf1, Lf1, respectively. Therefore, the rotatable control members 122 can easily be rotated by the thumbs Rf1, Lf1.

As shown in FIG. 12, when the first and second grips 106, 108 are gripped respectively by the palms of the hands of the game player, the index fingers Rf2, Lf2 and middle fingers Rf3, Lf3 of the right and left hands can extend over positions where they can selectively press the first and second pressable control members 114a, 114b and 116a, 116b of the third and fourth control pads 44, 46.

As shown in FIG. 13, the manual controller 12 has a pair of vibration imparting mechanisms 128 for imparting vibrations to the user in order to make the game highly realistic.

- 25 -

As shown in FIG. 13, the vibration imparting mechanisms 128 are positioned near the proximal ends of the first and second grips 106, 108 that are held by the hands and fingers when the manual controller 12 is gripped by the user.

5 As shown in FIG. 14, each of the vibration imparting mechanisms 128 comprises a motor 130 energizable by a vibration generating command supplied from the entertainment apparatus 14, and an eccentric member 134 mounted eccentrically on a rotatable shaft 132 of the motor 130.

10 The eccentric member 134 comprises a weight 134 in the form of a heavy metal member having a semicircular cross-sectional shape. The weight 134 has an off-center hole 136 defined therein in which the rotatable shaft 132 is fitted.

15 As shown in FIG. 15, the motor 130 with the eccentric member 134 mounted on the rotatable shaft 132 has a motor housing 140 fitted in a recess 138 defined in a rectangular tubular member that is disposed in the first grip 106, for example.

20 When the motor 130 is energized, the rotatable shaft 132 rotates to cause the eccentric member 134 to rotate in an eccentric motion for thereby producing vibrations, which are imparted to the motor 130. The vibrations of the motor 130 are then transmitted via a peripheral wall 138a of the rectangular tubular member to the first grip 106, from which
25 the vibrations are applied to the hand and fingers that grip the first grip 106.

The vibration imparting mechanisms 128 disposed respectively in the first and second grips 106, 108 are arranged

to impart vibrations in different modes. For example, the motors 130 of the vibration imparting mechanisms 128 have different sizes such that when the motors 130 are energized at a constant voltage, their shafts 132 rotate at different speeds to rotate the eccentric members 134 at different speeds for thereby generating vibrations at different frequencies.

In order to energize the motors 130 to vibrate the manual controller 12 in its entirety, a bidirectional communication function needs to be provided between the manual controller 12 and the entertainment apparatus 14. This bidirectional communication function will be described later on.

Circuit arrangements of the portable information terminal 32, the entertainment apparatus 14, and the manual controller 12 will be described below with reference to FIGS. 16 through 20.

As shown in FIG. 16, the portable information terminal 32 comprises a hardware layer 150 for processing data received via an antenna 160 (see FIG. 17), and a software layer 152 for performing communications in the hardware layer 150, the software layer 152 comprising a wireless communication driver 154, a serial communication driver 156, and a communication application 158.

As shown in FIG. 17, the hardware layer 150 of the portable information terminal 32 comprises the antenna 160, a wireless communication block 162, a CPU 164, a working memory 166, an input block 168, a nonvolatile member 172, a display block 174, and a function block 176. These compo-

- 27 -

nents of the portable information terminal 32 are connected to a bus 178.

The wireless communication block 162 receives data transmitted as a wireless signal such as a microwave signal via the antenna 160. The reception of data by the wireless communication block 162 is controlled by the wireless communication driver 154 (see FIG. 16) which comprises a program.

The wireless communication block 162 has a memory 180 as a memory means for temporarily storing wireless signal data. The portable information terminal 32 can selectively receive the data based on information added to the data that have been received and temporarily stored in the wireless communication block 162. Specifically, when the portable information terminal 32 selectively receives the data, the data temporarily stored in the wireless communication block 162 are read into the nonvolatile memory 172.

The working memory 166 serves as a memory means for use as a working area for various data.

The input block 168 is arranged to function as a manual input controller. Therefore, the input block 168 allows the user to enter various items of information into the portable information terminal 32.

The nonvolatile memory 172 serves as a memory means for storing various data. The nonvolatile memory 172 stores data received via the antenna 160 and data sent from the entertainment apparatus 14 via the serial communication block 170.

The display block 174 is arranged to function as a dis-

- 28 -

play unit for displaying various items of information. The display block 174 displays various character information and image information on a liquid crystal panel, for example.

5 The serial communication block 170 has a function to effect serial communications with an external device. The serial communication block 170 is electrically connectable to a serial communication block 214 of the entertainment apparatus 14, for example, for data communications with the entertainment apparatus 14. The serial communication block 10 170 is controlled for its communications by the serial communication driver 156.

The functional block 176 is arranged to perform other functions than the above blocks, and may comprise a power supply block, for example.

15 The CPU 164 has a function to control the above blocks. For example, the CPU 164 controls the blocks according to various programs, such as the communication application 158, etc. of the above software layer 152.

20 As shown in FIG. 16, the manual controller 12 comprises a hardware layer 182 and a software layer 184 comprising application software 186 for controlling the hardware layer 182 and performing communications and a serial communication driver 188 included in the application software 186.

25 As shown in FIG. 18, the hardware layer 182 of the manual controller 12 comprises a serial communication block 190, a CPU 192, a program memory 194, a working RAM 196, a digital input block 198, an analog input block 200, and a motor 130. These components of the manual controller 12 are

- 29 -

connected to a bus 202.

The digital input block 198 functions as a manual input controller for the first through fourth pressable control members 110a - 110d of the first control pad 40 and the first through fourth pressable control members 112a - 112d of the second control pad 42. The analog input block 200 functions as a manual input controller for the rotatable control members 122. The digital input block 198 and the analog input block 200 allow the user to enter various items of information into the manual controller 12.

The serial communication block 190 has a function to effect serial communications with an external device. The serial communication block 190 is electrically connectable to the serial communication block 214 of the entertainment apparatus 14, for example, for data communications with the entertainment apparatus 14. The serial communication block 190 is controlled for its communications by the serial communication driver 188.

As shown in FIG. 16, the entertainment apparatus 14 comprises a hardware layer 204 and a software layer 206 comprising application software 208 for controlling the hardware layer 204 and performing communications and image processing, and serial communication drivers 210, 212 included in the application software 208.

As shown in FIG. 19, the hardware layer 204 of the entertainment apparatus 14 comprises the serial communication block 214, a CPU 216, an input block 218, a mass-storage medium block 220, a main memory 222, a graphic processor 224,

- 30 -

and a function block 226. These components of the hardware layer 204 are connected to a bus 228.

The input block 218 functions as a manual input controller for allowing the user to enter various items of information into the entertainment apparatus 14.

The main memory 222 serves as a memory means for storing various data. For example, the main memory 222 stores the application software 208 of the software layer 206. The main memory 222 also stores data transmitted from the portable information terminal 32 and the manual controller 12 via the serial communication block 214.

The graphic processor 224 serves as a processor for processing image data. For example, the graphic processor 224 performs graphic processing, e.g., polygon graphic processing, for images to be displayed on a display unit.

The mass-storage medium block 220 serves as a unit for reading various data recorded in a mass-storage medium such as a CD-ROM or the like.

The serial communication block 214 has a function to effect serial communications with an external device. The serial communication block 190 is electrically connectable to the serial communication block 170 of the portable information terminal 32 and the serial communication block 190 of the manual controller 12 for data communications with the portable information terminal 32 and the manual controller 12. The serial communication block 214 is controlled for its communications by the serial communication drivers 210, 212.

- 31 -

The functional block 226 is arranged to perform other functions than the above blocks, and may comprise a power supply block or a connection block for connection to the memory card as a recording medium and the portable information terminal 32, for example.

The CPU 216 functions to control the above blocks of the entertainment apparatus 14. For example, the CPU 216 controls the blocks according to various programs such as the application software 208 of the software layer 206.

As shown in FIG. 20, the bidirectional communication function between the manual controller 12 and the entertainment apparatus 14 can be performed when the connection terminal 62 capable of performing bidirectional serial communications with the manual controller 12 is connected to the entertainment apparatus 14.

A system in the manual controller 12 for performing the bidirectional communication function comprises a serial I/O interface SIO for performing serial communication with the entertainment apparatus 14, a parallel I/O interface PIO for entering control data from a plurality of control buttons, a one-chip microcomputer comprising a CPU, a RAM, and a ROM, and a motor driver 230 for energizing the motors 130 of the vibration imparting mechanisms 128. Each of the motors 130 is energized by a voltage and a current supplied from the motor driver 230.

A system in the entertainment apparatus 14 for performing the bidirectional communication function comprises a serial I/O interface SIO for performing serial communication

- 32 -

with the manual controller 12. When the connection terminal 62 is connected to the serial I/O interface SIO of the entertainment apparatus 14, the serial I/O interface SIO of the entertainment apparatus 14 is connected to the serial I/O interface SIO of the manual controller 12 via the connection terminal 62 for performing bidirectional communications between the manual controller 12 and the entertainment apparatus 14. Other detailed structure of the entertainment apparatus 14 are omitted from illustration in FIG. 20.

Signal and control lines for bidirectional serial communications include a data transfer signal line TXD (Transmit X' for Data) for sending data from the entertainment apparatus 14 to the manual controller 12, a data transfer signal line RXD (Received X' for Data) for sending data from the manual controller 12 to the entertainment apparatus 14, a serial synchronous clock signal line SCK (Serial Clock) for extracting data from the data transfer signal lines TXD, RXD, a control line DTR (Data Terminal Ready) for establishing and cutting off communication with the manual controller 12 as a terminal, and a flow control line DSR (Data Set Ready) for transferring a large amount of data.

The signal and control lines for bidirectional serial communication are accommodated in a cable. This cable further includes a power line 232 extending from a power supply in the entertainment apparatus 14 and connected to the motor drivers 230 in the manual controller 12 for supply electric energy to energize the motors 130.

A process of bidirectional serial communication between

- 33 -

the manual controller 12 and the entertainment apparatus 14 will be described below. In order for the entertainment apparatus 14 to communicate with the manual controller 12 to read control data of the control buttons (button information) of the first, second, third, and fourth control pads 40, 42, 44, 46, the entertainment apparatus 14 first outputs selection data to the control line DTR. As a result, the manual controller 12 confirms that it is selected by the control line DTR, and then waits for a signal from the signal line TXD. Then, the entertainment apparatus 14 outputs an identification code indicative of the manual controller 12 to the data transfer signal line TXD. The manual controller 12 receives the identification code from the signal line TXD.

When the manual controller 12 recognizes the identification code, the manual controller 12 starts communicating with the entertainment apparatus 14. The entertainment apparatus 14 sends control data via the data transfer signal line TXD to the manual controller 12, which sends control data produced by a control button via the data transfer signal line RXD to the entertainment apparatus 14. In this manner, the entertainment apparatus 14 and the manual controller 12 perform bidirectional serial communications. The bidirectional serial communications will be finished when the entertainment apparatus 14 outputs selection stop data via the control line DTR.

With the bidirectional serial communication function, the manual controller 12 can send mainly control data of

control buttons to the entertainment apparatus 14, and the entertainment apparatus 14 can send a vibration generating command for energizing the motors 156 of the vibration imparting mechanisms 128 via the data transfer signal line TXD to the manual controller 12.

The vibration generating command for energizing the motors 156 has been established in advance in a CD-ROM set in the entertainment apparatus 14. Depending on the motion target for the user who plays the game, the entertainment apparatus 14 sends the vibration generating command to the manual controller 12 to feed back vibrations for a certain period of time to the manual controller 12.

A characteristic function of the entertainment system according to the present embodiment will be described below with reference to FIGS. 21 through 43.

The characteristic function is a function to output a command for generating vibrations to the manual controller 12 in response to a wireless signal which is received by the portable information terminal 32.

The software for performing the above function comprises, as shown in FIG. 21, a wireless communication means 300, incorporated in the portable information terminal 32, for receiving a wireless signal, a vibration generation instructing means 302, incorporated in the entertainment apparatus 14, for outputting a command (vibration generating command) for causing the manual controller 12 to generate vibrations, and a vibration generating means 304, incorporated in the manual controller 12, for energizing the motors

130 based on the vibration generating command from the entertainment apparatus 14.

The wireless communication means 300 is executed by the CPU 164 of the portable information terminal 32 when downloaded from a certain CD-ROM or the like, for example, played back by the entertainment apparatus 14 into the working memory 166 of the portable information terminal 32 according to a predetermined process.

The vibration generation instructing means 302 is executed by the CPU 216 of the entertainment apparatus 14 when downloaded from a certain CD-ROM or the like, for example, played back by the entertainment apparatus 14 into the working memory 222 of the entertainment apparatus 14 according to a predetermined process.

The vibration generating means 304 is executed by the CPU 192 of the manual controller 12 when transferred from the program memory 194 to the working RAM 196, for example, of the manual controller 12.

As shown in FIG. 22, the wireless communication means 300 comprises a reception determining means 310 for determining whether there is received data in the wireless communication block 162 or not, a data transfer means 312 for transferring received data to the nonvolatile memory 172 if there is such received data in the wireless communication block 162, a transfer request determining means 314 for determining whether there is a data transfer request from the entertainment apparatus 14 via the serial communication block 170 or not, a communication link establishing means

- 36 -

316 for starting to communicate with the serial communication block 214 of the entertainment apparatus 14 via the serial communication block 170 to establish a communication link therewith if there is a data transfer request, a data sending means 318 for sending the data in the nonvolatile memory 172 to the entertainment apparatus 14 via the established communication link, and an end determining means 320 for determining whether processing in the portable information terminal 32 is ended or not.

There are different types of received data that are received by the wireless communication block 162. FIG. 23A shows a first type of received data which essentially comprises a character string part. FIG. 23B shows a second type of received data which essentially comprises a receiver definition part and a character string part. FIG. 23C shows a third type of received data which essentially comprises a sender definition part, a receiver definition part, and a character string part. FIG. 23D shows a fourth type of received data which essentially comprises a sender definition part, a receiver definition part, a vibration generator definition part, a vibration intensity definition part, a vibration frequency definition part, and a character string part.

There are available several modes of use of the portable information terminal 32, the entertainment apparatus 14, and the manual controller 12. FIG. 24 shows a first mode of use in which one portable information terminal 32 and one manual controller 12 are connected to one entertainment

- 37 -

apparatus 14. FIG. 25 shows a second mode of use in which one portable information terminal 32 and a plurality of (two in FIG. 25) manual controllers 12 are connected to one entertainment apparatus 14.

5 FIG. 26 shows a third mode of use in which a plurality of (two in FIG. 26) portable information terminals 32 and a plurality of (two in FIG. 26) manual controllers 12 are connected to one entertainment apparatus 14. FIG. 27 shows a fourth mode of use in which a plurality of (two in FIG. 26) portable information terminals 32 and a plurality of (two in FIG. 26) manual controllers 12 are connected to one entertainment apparatus 14 via a connection hub 322, and one portable information terminal 32 and one manual controller 12 are connected to the entertainment apparatus 14.

15 As shown in FIG. 28, the vibration generation instructing means 302 of the entertainment apparatus 14 comprises a user setting means 330 for searching for manual controllers 12 connected to the entertainment apparatus 14 and generating an association table (a user information table shown in FIG. 29) between identification codes corresponding to the manual controllers 12 and port numbers to which the manual controllers 12 are connected, if the received data is of either one of the second, third, and fourth types (see FIGS. 23B - 23D), and a terminal setting means 332 for searching for portable information terminals 32 connected to the entertainment apparatus 14 and generating a table (a terminal information table shown in FIG. 30) of port numbers to which the portable information terminals 32 are connected, if the

- 38 -

portable information terminal 32, the entertainment apparatus 14, and the manual controller 12 are in either the third or fourth mode of use (see FIG. 26 or 27).

The vibration generation instructing means 302 also has
5 a communication requesting means 334 for sending a transfer request for control data or a sending request for a vibration generating command VC to the manual controller 12 via the serial communication block 214 or sending a transfer request for received data to the portable information terminal
10 32, a communication link establishing means 336 for starting to communicate with the serial communication block 190 of the manual controller 12 or the serial communication block 170 of the portable information terminal 32 via the serial communication block 214 to establish a communication link
15 therewith, a data receiving means 338 for receiving control data from the manual controller 12 or received data from the portable information terminal 32 via the established communication link and storing the data in the main memory 222, an application executing means 340 for executing an application
20 in operation according to the received control data, a reception determining means 342 for determining whether there is received data from the portable information terminal 32 or not, a data analyzing means 344 for analyzing the received data to generate a vibration generating command VC,
25 a command sending means 346 for sending the vibration generating command VC to the manual controller 12 via the serial communication block 214, a processing completion determining means 348 for determining the completion of the send-

- 39 -

ing of a transfer request to the manual controller 12 and the portable information terminal 32, and an end determining means 350 for determining whether processing in the entertainment apparatus 14 is ended or not.

5 Of these means of the vibration generation instructing means 302, the communication requesting means 334, the communication link establishing means 336, the data receiving means 338, and the reception determining means 342 jointly
10 function as a monitoring means 352 for monitoring the reception of data by the portable information terminal 32.

As shown in FIG. 31, the vibration generating means 304 of the manual controller 12 comprises a transfer request determining means 360 for determining whether there is a data transfer request from the entertainment apparatus 14 via the
15 serial communication block 190 or not, a communication link establishing means 362 for starting to communicate with the serial communication block 214 of the entertainment apparatus 14 via the serial communication block 190 to establish a communication link therewith if there is a data transfer re-
20 quest from the entertainment apparatus 14, a sending/reception determining means 364 for determining whether the data transfer request from the entertainment apparatus 14 is a data sending request or a data reception request, a control data sending means 366 for sending control data from
25 the digital input block 198 and the analog input block 200 via the established communication link, a command receiving means 368 for receiving a vibration generating command VC from the entertainment apparatus 14 via the established com-

munication link, a command analyzing means 370 for analyzing the received vibration generating command VC and outputting an analyzed result to the motor driver 230 to energize the motor 130 corresponding to the vibration generating command VC to produce vibrations at an intensity and a frequency represented by the vibration generating command VC, and an end determining means 372 for determining whether processing in the manual controller 12 is ended or not.

Prior to describing processing sequences of the wireless communication means 300, the vibration generation instructing means 302, and the vibration generating means 304, processing sequences of the wireless communication block 162 of the portable information terminal 32 will be described below with reference to FIGS. 32 and 33.

If the received data is of the first type (see FIG. 23A), then the wireless communication block 162 determines whether data is received via the antenna 160 or not in step S1 shown in FIG. 32. If data is received via the antenna 160, then the received data is stored in a given area of the memory 180 in step S2. Then, the wireless communication block 162 determines whether there is an end request to end the processing in the portable information terminal 32 or not in step S3. If there is no end request, then control goes back to step S1 in which the wireless communication block 162 determines again whether data is received via the antenna 160 or not. If there is an end request, then the processing sequence of the wireless communication block 162 is ended.

- 41 -

If the received data is of either one of the second through fourth types (see FIGS. 23B - 23D), then the wireless communication block 162 determines whether data is received via the antenna 160 or not in step S101 shown in FIG.

5 33. If data is received via the antenna 160, then the wireless communication block 162 reads an identification code, for example of a received defined in the receiver definition part of the received data in step S102.

10 Then, the wireless communication block 162 determines whether the portable information terminal 32 is the receiver or not in step S103. Specifically, the wireless communication block 162 determines whether the identification code registered in the memory 180 is the same as the read identification code in the receiver definition part or not. If
15 the identification codes are the same as each other, then the portable information terminal 32 is determined as the receiver. Thereafter, the received data is stored in a given area of the memory 180 in step S104.

20 After the received data is stored in the memory 180 in step S104 or the portable information terminal 32 is not determined as the receiver in step S103, the wireless communication block 162 determines whether there is an end request to end the processing in the portable information terminal 32 or not in step S105. If there is no end request, then
25 control goes back to step S101 in which the wireless communication block 162 determines again whether data is received via the antenna 160 or not. If there is an end request, then the processing sequence of the wireless communication

- 42 -

block 162 is ended.

Therefore, if the received data is of the first type (see FIG. 23A), then when data is received by the portable information terminal 32, the received data is stored in the memory 180 of the wireless communication block 162. If the received data is of either one of the second through fourth types (see FIGS. 23B - 23D), then the received data is stored in the memory 180 of the wireless communication block 162 of the portable information terminal 32 which corresponds to the data in the receiver definition part of the received data.

Specifically, the received data is of the first type (see FIG. 23A), then in the first through fourth modes of use shown in FIGS. 24 through 27, all connected portable information terminals 32 store the received data in the memory 180. If the received data is of either one of the second through fourth types (see FIGS. 23B - 23D), then only the corresponding portable information terminal 32 stores the received data in the memory 180.

The processing sequences of the wireless communication means 300, the vibration generation instructing means 302, and the vibration generating means 304 will be described below with reference to FIGS. 34 through 38.

First, in the wireless communication means 300 of the portable information terminal 32, the reception determining means 310 reads data from the wireless communication block 162 in step S201. Thereafter, the reception determining means 310 determines whether the read data is received data

- 43 -

or not, by determining, for example, whether the read data is initial data or not, in step S202.

5 If the read data is received data, rather than initial data, then the data transfer means 312 transfers the received data to a given storage area of the nonvolatile memory 172, for example, and initializes the data in the memory 180 of the wireless communication block 162, in step S203. The received data is stored in the nonvolatile memory 172 together with an identification code indicative of the re-
10 ceived data, which is added to the beginning end of the received data.

After step S203 or if the read data is not received data in step S202, control proceeds to step S204 in which the transfer request determining means 314 determines whether
15 there is a data transfer request from the entertainment apparatus 14.

If there is not a data transfer request from the entertainment apparatus 14, then control returns to step S201 to confirm the presence or absence of received data again. If
20 there is a data transfer request from the entertainment apparatus 14, then the communication link establishing means 316 starts to communicate with the serial communication block 214 of the entertainment apparatus 14 via the serial communication block 170 to establish a communication link
25 therewith.

In step S206, the data sending means 318 sends the data in the nonvolatile memory 172 to the entertainment apparatus 14 via the established communication link. The data that is

- 44 -

sent by the data sending means 318 is the data generated by the portable information terminal 32 or the received data supplied to the wireless communication block 162.

In step S207, the end determining means 320 determines whether there is an end request to end processing in the portable information terminal 32 or not. If there is no end request, then control goes back to step S201 for confirming received data again and sending data based on a data transfer request from the entertainment apparatus 14.

If there is an end request in step S207, the processing sequence of the wireless communication means 300 is brought to an end.

The processing sequence of the vibration generation instructing means 302 of the entertainment apparatus 14 will be described below with reference to FIGS. 35 and 36.

If the received data is of either one of the second through fourth types (see FIGS. 23B - 23D), then the user setting means 330 of the vibration generation instructing means 302 searches for manual controllers 12 connected to the entertainment apparatus 14 and generating an association table (the user information table shown in FIG. 29) between identification codes corresponding to the manual controllers 12 and port numbers to which the manual controllers 12 are connected, in step S301 shown in FIG. 35. If the received data is of the first type (see FIG. 23A), then the processing of step S301 is not executed.

If the portable information terminal 32, the entertainment apparatus 14, and the manual controller 12 are in

- 45 -

either the third or fourth mode of use (see FIG. 26 or 27), then the terminal setting means 332 searches for portable information terminals 32 connected to the entertainment apparatus 14 and generating a table (the terminal information table shown in FIG. 30) of port numbers to which the portable information terminals 32 are connected, in step S302. If the portable information terminal 32, the entertainment apparatus 14, and the manual controller 12 are in either the first or second mode of use (see FIG. 24 or 25), then the processing of step S302 is not executed.

In step S303, the vibration generation instructing means 302 stores an initial value "1" in an index register 1 used to search for manual controllers 12, thus initializing the index register 1.

In step S304, the communication requesting means 334 sends a transfer request for control data to an *i*th manual controller 12 via the serial communication block 214 while referring to the user information table.

In step S305, the communication link establishing means 336 starts to communicate with the serial communication block 190 of the *i*th manual controller 12 via the serial communication block 214 to establish a communication link therewith.

In step S306, the data receiving means 338 receives control data from the *i*th manual controller 12 via the established communication link and stores the data in the main memory 222. Thereafter, in step S307, the application executing means 340 executes an application in operation ac-

- 46 -

according to the received control data.

In step S308, the value of the index register *i* is incremented by "+ 1". Thereafter, in step S309, the processing completion determining means 348 determines the completion of the sending of a transfer request to all the manual controllers 12 by determining whether the value of the index register *i* is greater than the number *M* of connected manual controllers 12 or not.

If the value of the index register *i* is equal or smaller than the number *M* of connected manual controllers 12 and the transfer request has not been sent to all the manual controllers 12, then control returns to step S304 in which a transfer request for control data is sent to the next manual controller 12.

If the transfer request has been sent to all the manual controllers 12 in step S309, control proceeds to step S310 shown in FIG. 36 in which the vibration generation instructing means 302 stores an initial value "1" in an index register *j* used to search for portable information terminal 32, thus initializing the index register *j*.

Thereafter, in step S311, the communication requesting means 334 sends a transfer request for data to a *j*th portable information terminal 32 via the serial communication block 214 while referring to the terminal information table.

In step S312, the communication link establishing means 336 starts to communicate with the serial communication block 170 of the *j*th portable information terminal 32 via the serial communication block 214 to establish a communica-

- 47 -

tion link therewith. This process of establishing the communication link is carried out in coordination with the process of establishing the communication link with the wireless communication means 300 of the jth portable information terminal 32 in step S205.

In step S313, the data receiving means 338 receives data transferred from the jth portable information terminal 32 via the established communication link and stores the data in the main memory 222.

Thereafter, in step S314, the reception determining means 342 determines whether the transferred data is data received in a wireless manner or not by determining whether an identification code indicative of received data is present at the beginning end of the transferred data or not.

If the transferred data is received data, then control goes to step S315 in which the data analyzing means 344 analyzes the received data and generates a vibration generating command VC.

If the received data is of either one of the first, second, and third types (see FIGS. 23A - 23C), for example, then since the received data contains no vibration generator definition part, the data analyzing means 344 generates a vibration generating command VC including instructing information for causing all the motors 130 or the right-hand motor 130, for example, in the manual controller 12 to generate vibrations, and information relative to a vibration intensity and a vibration frequency.

For generating a vibration generating command VC, an

- 48 -

association table (vibration information table) of character strings, vibration intensities, and vibration frequencies as shown in FIG. 37 may be prepared in advance, and a vibration intensity and a vibration frequency which correspond to a character string contained in the character string part of the received data may be read from the association table and registered in a vibration generating command VC.

If the received data is of the fourth type (FIG. 23D), then the type of the motor 130, the vibration intensity, and the vibration frequency which are included in the vibration generator definition part, the vibration intensity definition part, and the vibration frequency definition part of the received data may directly be registered in a vibration generating command VC.

In step S316, the communication link establishing means 336 starts to communicate with the serial communication block 190 of the manual controller 12 which corresponds to the identification code included in the sender definition part of the received data, via the serial communication block 214 to establish a communication link therewith.

If the received data is of the second type (FIG. 23B), then since the received data contains no sender definition part, the communication link establishing means 336 may start to communicate with the serial communication block 190 of a manual controller 12 close to the portable information terminal 32 corresponding to the identification code included in the sender definition part of the received data, i.e., a physically closest manual controller 12, to establish a

- 49 -

communication link therewith. This scheme is also applicable even if the received data is of the first type (see FIG. 23A) or if the received data is of the third or fourth type (see FIG. 23C or 23D).

5 If the received data is of the first type (see FIG. 23A), since the received data contains no sender definition part and no receiver definition part, the communication link establishing means 336 starts to communicate with the serial communication blocks 190 of all connected manual controllers
10 12 (usually, one manual controller 12) to establish a communication link therewith. This process is also applicable even if the received data is of either one of the second through fourth types.

 The communication link establishing means 336 thus
15 functions as a selecting means for selecting one or more manual controllers 12 depending on the content of the wireless signal (received data) received by the portable information terminal 32.

 In step S317, the command sending means 346 sends the
20 vibration generating command VC to the corresponding manual controller 12 via the established communication link.

 In step S318, the value of the index register j is incremented by "+ 1". Thereafter, in step S319, the processing completion determining means 348 determines the completion of the sending of a data transfer request to all the
25 portable information terminals 32 by determining whether the value of the index register j is greater than the number N of connected portable information terminals 32 or not.

- 50 -

If the value of the index register j is equal or smaller than the number N of connected portable information terminals 32 and the transfer request has not been sent to all the portable information terminals 32, then control returns
5 to step S303 in which a transfer request for is sent to the next portable information terminal 32.

If the transfer request has been sent to all the portable information terminals 32 in step S319, control proceeds to step S320 in which the end determining means 320 determines whether there is an end request to end processing in
10 the entertainment apparatus 14 or not. If there is no end request, then control goes back to step S303 for sending a transfer request to all the manual controllers 12 and a transfer request to all the portable information terminals
15 32.

If there is an end request in step S320, the processing sequence of the vibration generation instructing means 302 is brought to an end.

The processing sequence of the vibration generating
20 means 304 of the manual controller 12 will be described below with reference to FIG. 38.

In step S401, the transfer request determining means 360 waits for a transfer request for control data from the entertainment apparatus 14.

25 If there is a transfer request for control data from the entertainment apparatus 14, then the communication link establishing means 362 starts to communicate with the serial communication block 214 of the entertainment apparatus 14

- 51 -

via the serial communication block 190 to establish a communication link therewith in step S402. This process of establishing the communication link is carried out in coordination with the process of establishing the communication link in the vibration generation instructing means 302 of the entertainment apparatus 14 in step S305 or S316.

In step S403, the sending/reception determining means 364 determines whether the present data transfer request from the entertainment apparatus 14 is a request for sending control data.

If the data transfer request is a request for sending control data, then the control data sending means 366 sends control data from the digital input block 198 and the analog input block 200 via the established communication link in step S404. If the data transfer request is not a request for sending control data, but a request for receiving a vibration generating command VC, then control goes to step S405 in which the command receiving means 368 receives a vibration generating command VC from the entertainment apparatus 14 via the established communication link.

Thereafter, in step S406, the command analyzing means 370 analyzes the received vibration generating command VC and outputs an analyzed result to the motor driver 230. The motor driver 230 supplies a drive current at the vibration intensity and the vibration frequency contained in the received vibration generating command VC, to the motor 130 corresponding to the type of the motor 130 contained in the received vibration generating command VC, energizing the mo-

- 52 -

tor 130 to produce vibrations at the intensity and the frequency represented by the vibration generating command VC.

After the processing of step S404 or S406, control proceeds to step S407 in which the end determining means 372
5 determines whether there is an end request for ending processing in the manual controller 12 or not. If there is no end request, control goes back to step S401 for sending control data or receiving a vibration generating command VC again.

10 If there is an end request in step S407, then the processing sequence of the vibration generating means 304 is brought to an end.

In the entertainment system according to the present embodiment, when the portable information terminal 32 receives a wireless signal, a command (vibration generating
15 command VC) for generating vibrations is outputted to the manual controller 12. Therefore, the reception of a wireless signal by the portable information terminal 32 can be transmitted to the user via a tactile sensation.

20 As a result, the user can receive specific or arbitrary information by way of a wireless signal while viewing the display screen of a television receiver connected to the entertainment system 10. Since the manual controller 12 vibrates when the portable information terminal 32 receives
25 the information, the user can recognize that the specific or arbitrary information has been received by sensing the vibrations of the manual controller 12.

Consequently, when the user is enjoying a game while

- 53 -

watching an image displayed on the display screen of the television receiver, it is possible to indicate to the user the arrival of a wireless signal without disturbing the displayed image on the display screen.

5 If the user is playing a competition game together with another game player at a distance via the Internet, then a result produced by an action of the user can be transmitted with vibrations to the user, so that the game can be played with a highly realistic effect.

10 In the above embodiment, the selecting means (communication link establishing means 336) for selecting at least one manual controller 12 depending on the content of a wireless signal (received data) received by the portable information terminal 32 is included in the vibration generation
15 instructing means 302 of the entertainment apparatus 14, and the vibration generation instructing means 302 outputs a vibration generating command VC to the selected manual controller 12. Therefore, at least one, which corresponds to the content of the data received by the portable information
20 terminal 32, of manual controllers 12 connected to the entertainment apparatus 14 is vibrated.

25 Therefore, when a plurality of users or game players handling respective manual controllers 12 connected to one entertainment apparatus 14 are retrieving various items of information or playing a competition game, the reception of a wireless signal by the portable information terminal 32 is transmitted as vibrations to one of the users which corresponds to the content of the wireless signal. Accordingly,

- 54 -

it is possible to provide various items of information to the users and allow the users to experience a variety of game developments.

In this embodiment, if plural portable information terminals 32 and plural manual controllers 12 are connected to the entertainment apparatus 14 as in the third and fourth modes of use (see FIGS. 26 and 27), the vibration generation instructing means 302 outputs a vibration generating command VC to the manual controller 12 which corresponds to the portable information terminal 32 which has received a wireless signal.

Consequently, it is possible to indicate the reception of information individually to users corresponding to the content received by the portable information terminal 32 which has received a wireless signal.

In the above embodiment, furthermore, since the level of vibrations produced by the manual controller 12, the type of the motor 130, the vibration intensity, and the vibration frequency are changed depending on the received message, for example, the user can easily recognize the received content through a tactile sensation.

Modifications of the entertainment system 10 will be described below with reference to FIGS. 39 through 43.

The modified entertainment system 10 is of essentially the same arrangement as the entertainment system 10 described above, but has a wireless communication means 300a and a vibration instructing means 302a which are different from those of the entertainment system 10 described above.

- 55 -

As shown in FIG. 39, the modified wireless communication means 300a has, in addition to the reception determining means 310, the data transfer means 312, the communication link establishing means 316, the data sending means 318, and the end determining means 320, an interrupt signal generating means 380 for generating and outputting an interrupt signal Sr to the entertainment apparatus 14 if there is received data in the wireless communication block 162.

As shown in FIG. 40, the modified vibration instructing means 302a has, in addition to the user setting means 330, the terminal setting means 332, the communication requesting means 334, the communication link establishing means 336, the data receiving means 338, the application executing means 340, the data analyzing means 344, the command sending means 346, the processing completion determining means 348, and the end determining means 350, an interrupt determining means 382 for determining the entry of an interrupt signal Sr from the portable information terminal 32.

The modified wireless communication means 300a carries out steps S501 through S503, which correspond respectively to steps S201 through S203, as shown in FIG. 41. In steps S501 through S503, the wireless communication means 300a determines whether there is received data in the wireless communication means 162, and, if there is received data, stores such received data in the nonvolatile memory 172.

In step S504, the interrupt signal generating means 380 generates an interrupt signal Sr and outputs the generated interrupt signal Sr to the entertainment apparatus 14 via

- 56 -

the serial communication block 170.

The wireless communication means 300a starts to communicate with the serial communication block 214 of the entertainment apparatus 14 via the serial communication block 170 to establish a communication link therewith in step S505, and sends the received data from the nonvolatile memory 172 to the entertainment apparatus 14 via the established communication link in step S506.

In step S507, the wireless communication block 300a determines whether there is an end request to end the processing in the portable information terminal 32 or not. If there is no end request, then control goes back to step S501. If there is an end request, then the processing sequence of the wireless communication block 300a is ended.

As shown in FIG. 42, the modified vibration instructing means 302a performs a user setting process in step S601, and then performs a terminal setting process in step S602.

In step S603, the vibration generation instructing means 302a initializes the index register i. In step S604, the communication requesting means 334 sends a transfer request for control data to an ith manual controller 12 via the serial communication block 214 while referring to the user information table.

In step S605, the communication link establishing means 336 starts to communicate with the serial communication block 190 of the ith manual controller 12 via the serial communication block 214 to establish a communication link therewith. In step S606, the data receiving means 338 re-

- 57 -

ceives control data from the *i*th manual controller 12 via the established communication link and stores the data in the main memory 222. Thereafter, in step S607, the application executing means 340 executes an application in operation according to the received control data.

In step S608, the value of the index register *i* is incremented by "+ 1". Thereafter, in step S609, the processing completion determining means 348 determines the completion of the sending of a transfer request to all the manual controllers 12. If the transfer request has not been sent to all the manual controllers 12, then control returns to step S604 in which a transfer request for control data is sent to the next manual controller 12.

If the transfer request has been sent to all the manual controllers 12 in step S609, control proceeds to step S610 in which the interrupt determining means 382 determines whether there is an interrupt signal *Sr* from the portable information terminal 32 or not. If there is no interrupt signal *Sr*, then control goes back to step S603 to receive control data from the manual controller 12 again. If there is an interrupt signal *Sr*, then control proceeds to step S611 shown in FIG. 43 in which the communication link establishing means 336 starts to communicate with the serial communication block 162 of the portable information terminal 32, which has outputted the interrupt signal *Sr*, via the serial communication block 214 to establish a communication link therewith.

In step S612, the data receiving means 338 receives

- 58 -

data transferred from the portable information terminal 32 via the established communication link and stores the data in the main memory 222. Thereafter, in step S613, the data analyzing means 344 analyzes the received data and generates
5 a vibration generating command VC.

In step S614, the communication link establishing means 336 starts to communicate with the serial communication block 190 of the manual controller 12 which corresponds to the identification code included in the sender definition
10 part of the received data, via the serial communication block 214 to establish a communication link therewith. The processing of step S614 is the same as the processing of step S316 shown in FIG. 36.

In step S615, the command sending means 346 sends the
15 vibration generating command VC to the corresponding manual controller 12 via the established communication link.

The end determining means 320 determines whether there is an end request to end processing in the entertainment apparatus 14 or not in step S616. If there is no end request,
20 then control goes back to step S603. If there is an end request in step S616, the processing sequence of the vibration generation instructing means 302a is brought to an end.

The modified entertainment system 10 shown in FIGS. 39 and 40 is capable of transferring the reception of a signal
25 by the portable information terminal 32 to the user through a tactile sensation.

As a result, the user can receive specific or arbitrary information by way of a wireless signal while viewing the

- 59 -

display screen of a television receiver connected to the entertainment system 10. Since the manual controller 12 vibrates when the portable information terminal 32 receives the information, the user can recognize that the specific or
5 arbitrary information has been received by sensing the vibrations of the manual controller 12.

Consequently, when the user is enjoying a game while watching an image displayed on the display screen of the television receiver, it is possible to indicate to the user
10 the arrival of a wireless signal without disturbing the displayed image on the display screen.

As described above, the entertainment system has the portable information terminal which can be connected to the entertainment apparatus and used by the user, and allows the
15 reception of a signal by the portable information terminal to be transferred to the user through a tactile sensation.

In the entertainment system, the properties (intensity, frequency, and vibration generator type) of vibrations imparted to the user can be varied depending on a signal received by the portable information terminal, so that the
20 user can recognize the received signal through a tactile sensation.

In the entertainment system, a plurality of portable information terminals can be connected to a single entertainment apparatus and used by respective users, and information can be transmitted selectively to the user corresponding to data received by a portable information terminal.
25

- 60 -

A recording medium according to the present invention stores a program for allowing a portable information terminal to be connected to an entertainment apparatus and used by a user, and also allowing a signal received by the portable information terminal to be transmitted to the user through a tactile sensation.

A recording medium according to the present invention stores a program for allowing the properties (intensity, frequency, and vibration generator type) of vibrations imparted to a user to be varied depending on a signal received by a portable information terminal, so that the user can recognize the received signal through a tactile sensation.

A recording medium according to the present invention stores a program for allowing a plurality of portable information terminals to be connected to a single entertainment apparatus and used by respective users, and also allowing information to be transmitted selectively to the user corresponding to data received by a portable information terminal.

Although certain preferred embodiments of the present invention have been shown and described in detail, it should be understood that various changes and modifications may be made therein without departing from the scope of the appended claims.

- 61 -

CLAIMS

1. An entertainment system comprising:

an entertainment apparatus (14) for executing various
5 programs;

at least one manual controller (12) connected to said
entertainment apparatus (14) for entering manual control re-
quests from the user into said entertainment apparatus (14);
and

10 a portable information terminal (32) for receiving a
wireless signal and sending information to and receiving in-
formation from at least said entertainment apparatus (14);

said manual controller (12) having vibration generating
means (128) for applying vibrations to the user in response
15 to an external request;

said entertainment apparatus (14) having vibration gen-
eration instructing means (302) for outputting an instruc-
tion to generate vibrations to said manual controller (12)
in response to the reception of a wireless signal by said
20 portable information terminal (32).

2. An entertainment system according to claim 1, where-
in said entertainment apparatus (14) has monitoring means
(352) for monitoring the reception of data by said portable
25 information terminal (32), said vibration generation in-
structing means (302) comprising means for outputting an in-
struction to generate vibrations to said manual controller
(12) in response to the reception of data as detected by

said monitoring means (352).

3. An entertainment system according to claim 1, where-
in said portable information terminal (32) has interrupt
5 signal generating means (380) for generating an interrupt
signal in response to the reception of said wireless signal,
said vibration generation instructing means (302) comprising
means for outputting an instruction to generate vibrations
to said manual controller (12) in response to said interrupt
10 signal.

4. An entertainment system according to any one of
claims 1 to 3, wherein said entertainment apparatus (14) has
selecting means for selecting at least one of a plurality of
15 manual controllers (12) connected to said entertainment ap-
paratus (14) depending on the content of a wireless signal
received by said portable information terminal (32), said
vibration generation instructing means (302) comprising
means for outputting an instruction to generate vibrations
20 to the selected one of the manual controllers (12).

5. An entertainment system according to any one of
claims 1 to 4, wherein a plurality of portable information
terminals (32) and a plurality of manual controllers (12)
25 are connected to said entertainment apparatus (14), said vi-
bration generation instructing means (302) comprising means
for outputting an instruction to generate vibrations to the
manual controller (12) corresponding to the portable infor-

mation terminal (32) which has received said wireless signal.

5 6. An entertainment system according to claim 5, wherein said vibration generation instructing means (302) comprises means for outputting an instruction to generate vibrations to one of the manual controllers (12) which is physically closest to the portable information terminal (32) which has received said wireless signal.

10 7. An entertainment system according to claim 5, wherein said vibration generation instructing means (302) comprises means for outputting an instruction to generate vibrations to one of the manual controllers (12) which is
15 logically associated with the portable information terminal (32) which has received said wireless signal.

20 8. An entertainment system according to any one of claims 1 to 7, wherein said instruction to generate vibrations outputted from said vibration generation instructing means (302) includes a property of the vibrations depending on the signal received by said portable information terminal (32).

25 9. A recording medium which stores a program and data used by an entertainment system (10) comprising an entertainment apparatus (14) for executing various programs, at least one manual controller (12) connected to said enter-

- 64 -

tainment apparatus (14) for entering manual control requests from the user into said entertainment apparatus (14), and a portable information terminal (32) for receiving a wireless signal and sending information to and receiving information from at least said entertainment apparatus (14), said manual controller (12) having vibration generating means (128) for applying vibrations to the user in response to an external request, said program having the step of outputting an instruction to generate vibrations to said manual controller (12) in response to the reception of a wireless signal by said portable information terminal (32).

10. A recording medium according to claim 9, wherein said program further comprises the step of:

15 monitoring the reception of data by said portable information terminal (32);

said step of outputting an instruction comprising the step of outputting an instruction to generate vibrations to said manual controller (12) in response to the reception of data as detected by the monitoring step.

11. A recording medium according to claim 9, wherein said program further comprises the step of:

25 generating an interrupt signal from said portable information terminal (32) in response to the reception of said wireless signal;

said step of generating an instruction comprising the step of outputting an instruction to generate vibrations to

- 65 -

said manual controller (12) in response to said interrupt signal.

12. A recording medium according to any one of claims 9 to 11, wherein said program further comprises the step of:

selecting at least one of a plurality of manual controllers (12) connected to said entertainment apparatus (14) depending on the content of a wireless signal received by said portable information terminal (32);

said step of generating an instruction comprising the step of outputting an instruction to generate vibrations to the selected one of the manual controllers (12).

13. A recording medium according to any one of claims 9 to 12, wherein a plurality of portable information terminals (32) and a plurality of manual controllers (12) are connected to said entertainment apparatus (14), said step of generating an instruction comprising the step of:

outputting an instruction to generate vibrations to the manual controller (12) corresponding to the portable information terminal (32) which has received said wireless signal.

14. A recording medium according to claim 13, wherein said step of generating an instruction comprises the step of outputting an instruction to generate vibrations to one of the manual controllers (12) which is physically closest to the portable information terminal (32) which has received

- 66 -

said wireless signal.

15. A recording medium according to claim 13, wherein
said step of generating an instruction comprises the step of
5 outputting an instruction to generate vibrations to one of
the manual controllers (12) which is logically associated
with the portable information terminal (32) which has re-
ceived said wireless signal.

10 16. A recording medium according to any one of claims 9
to 15, wherein said instruction to generate vibrations out-
putted in said step of generating an instruction includes a
property of the vibrations depending on the signal received
by said portable information terminal (32).

FIG. 1

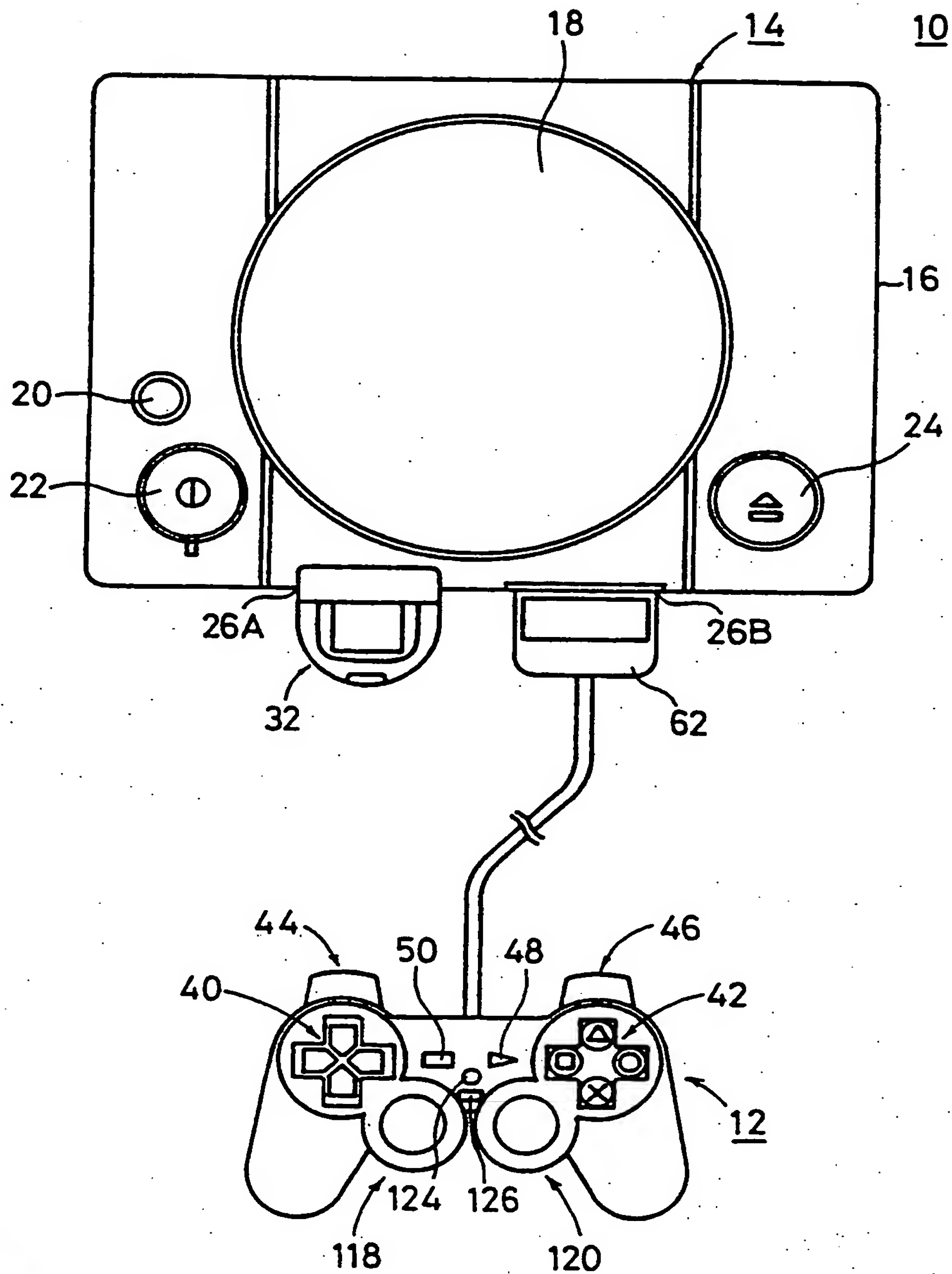
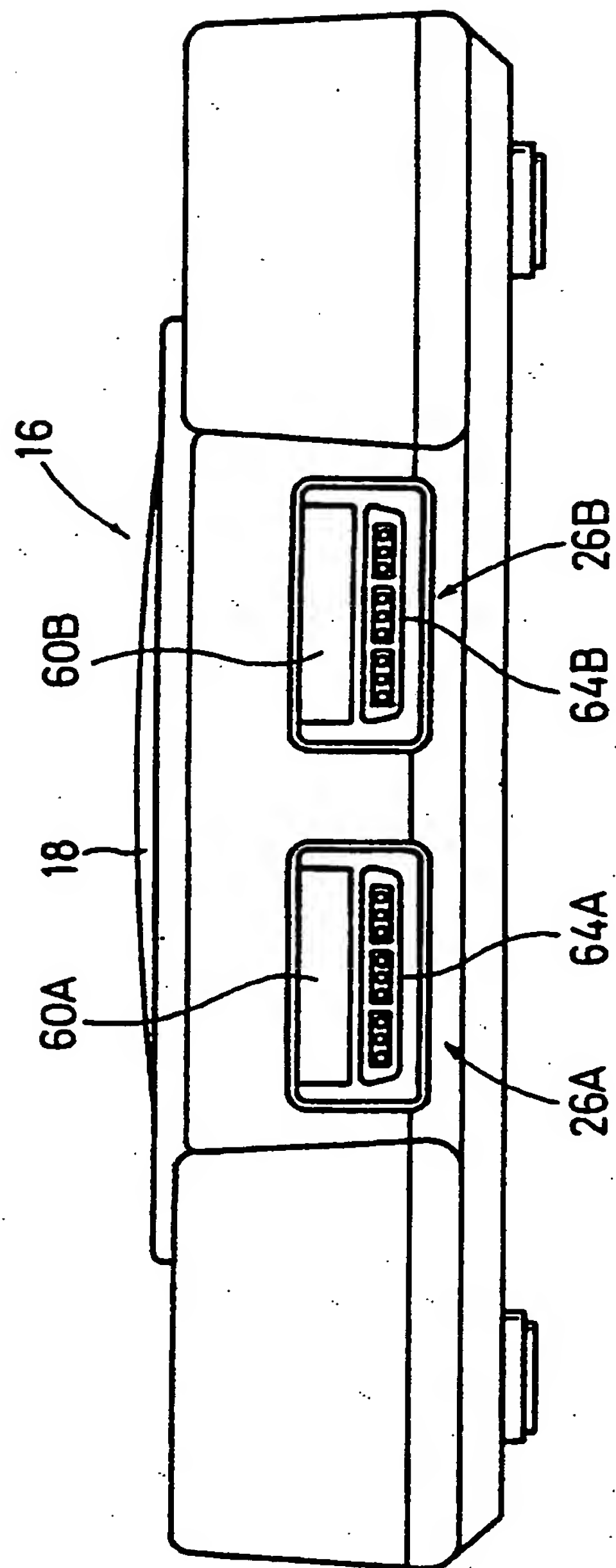


FIG. 2



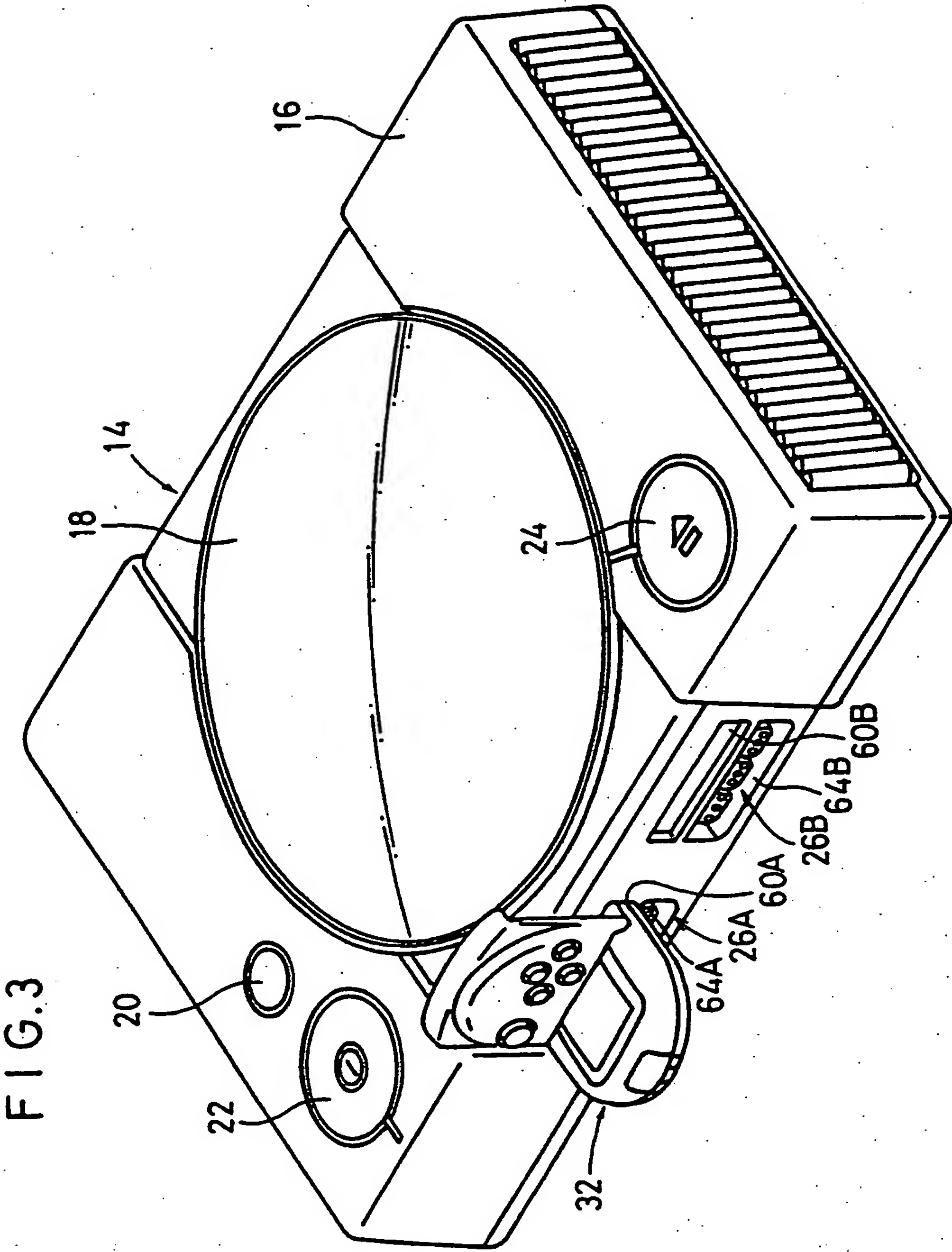


FIG. 4

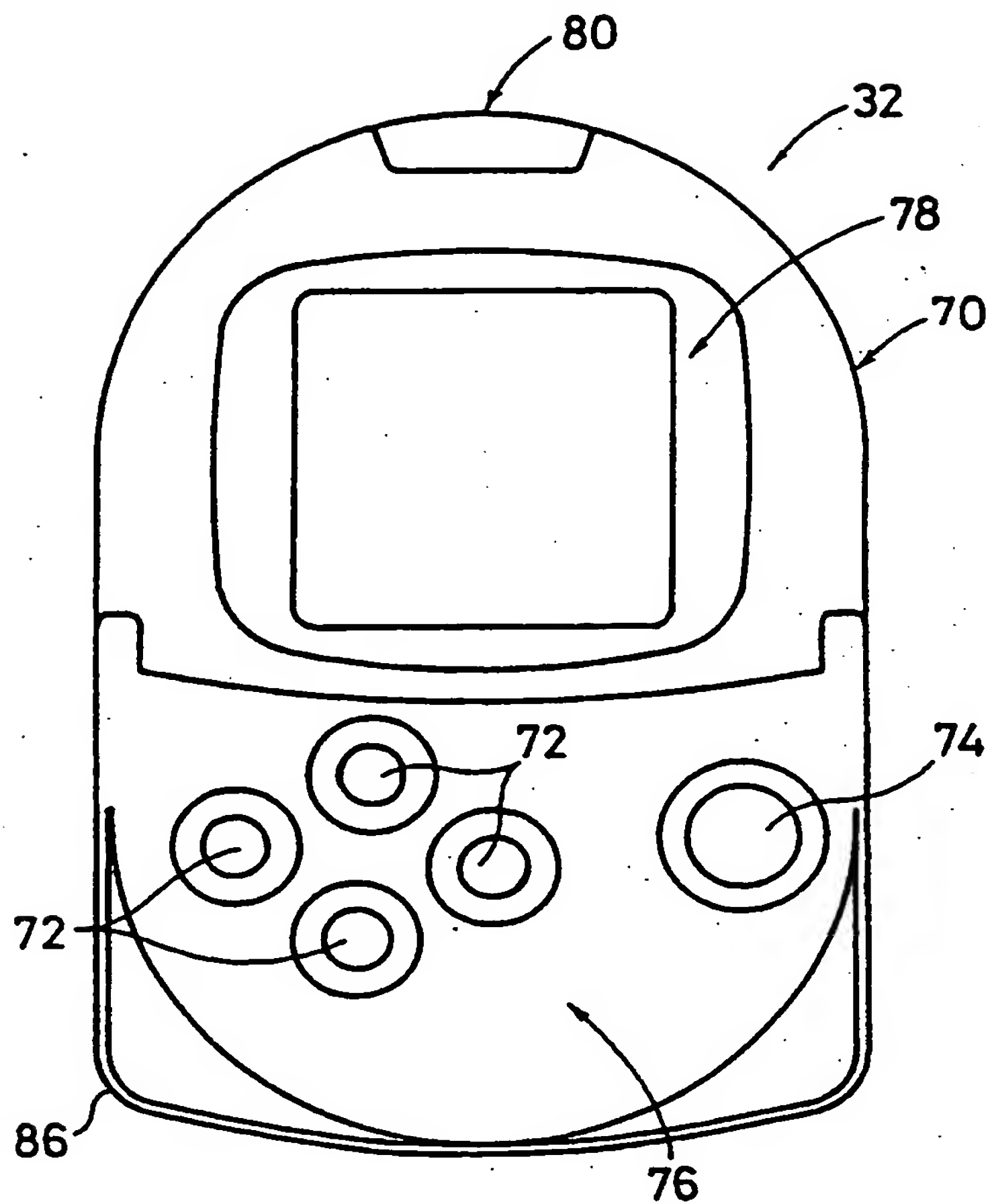


FIG. 5

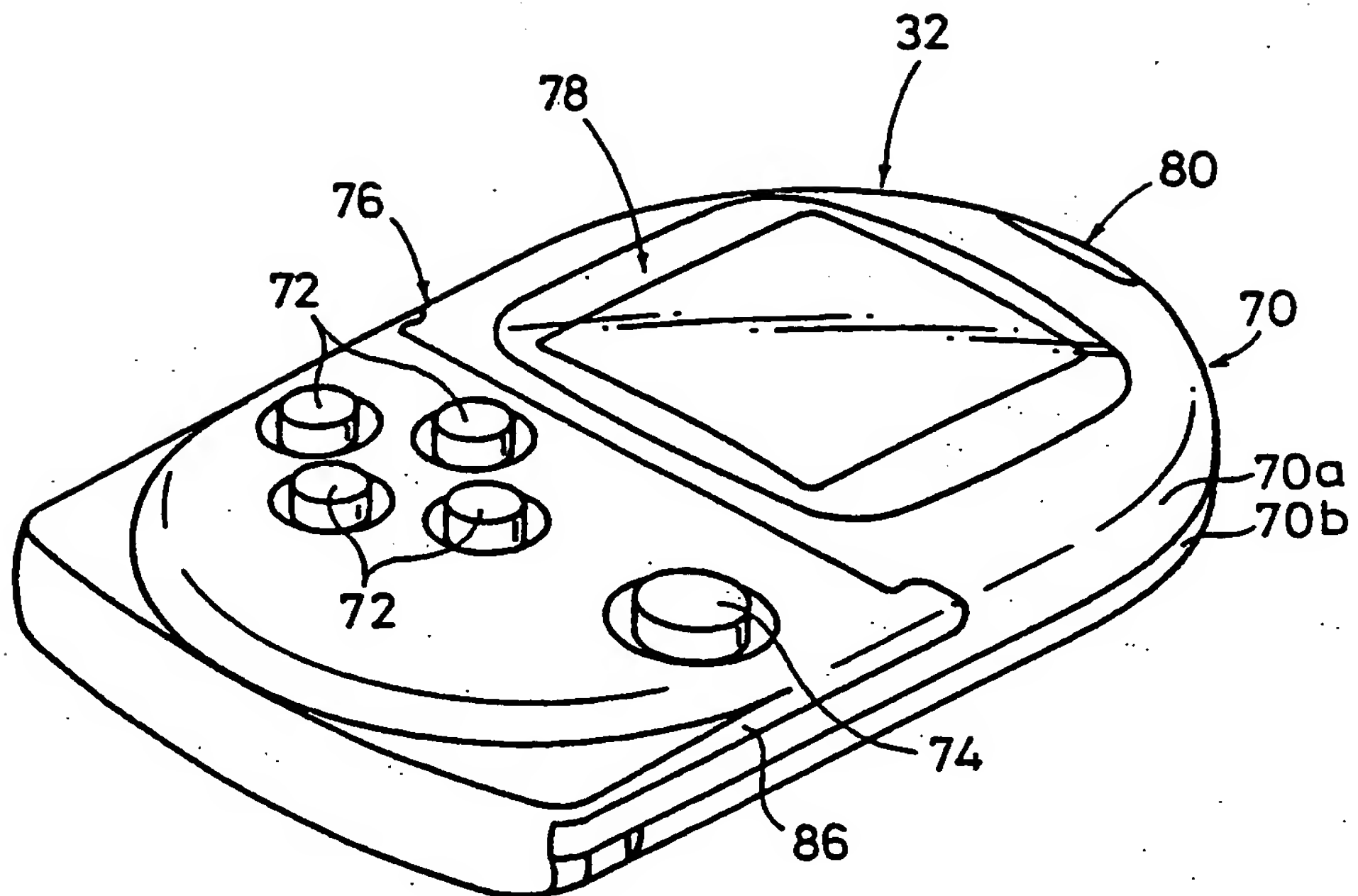


FIG. 6

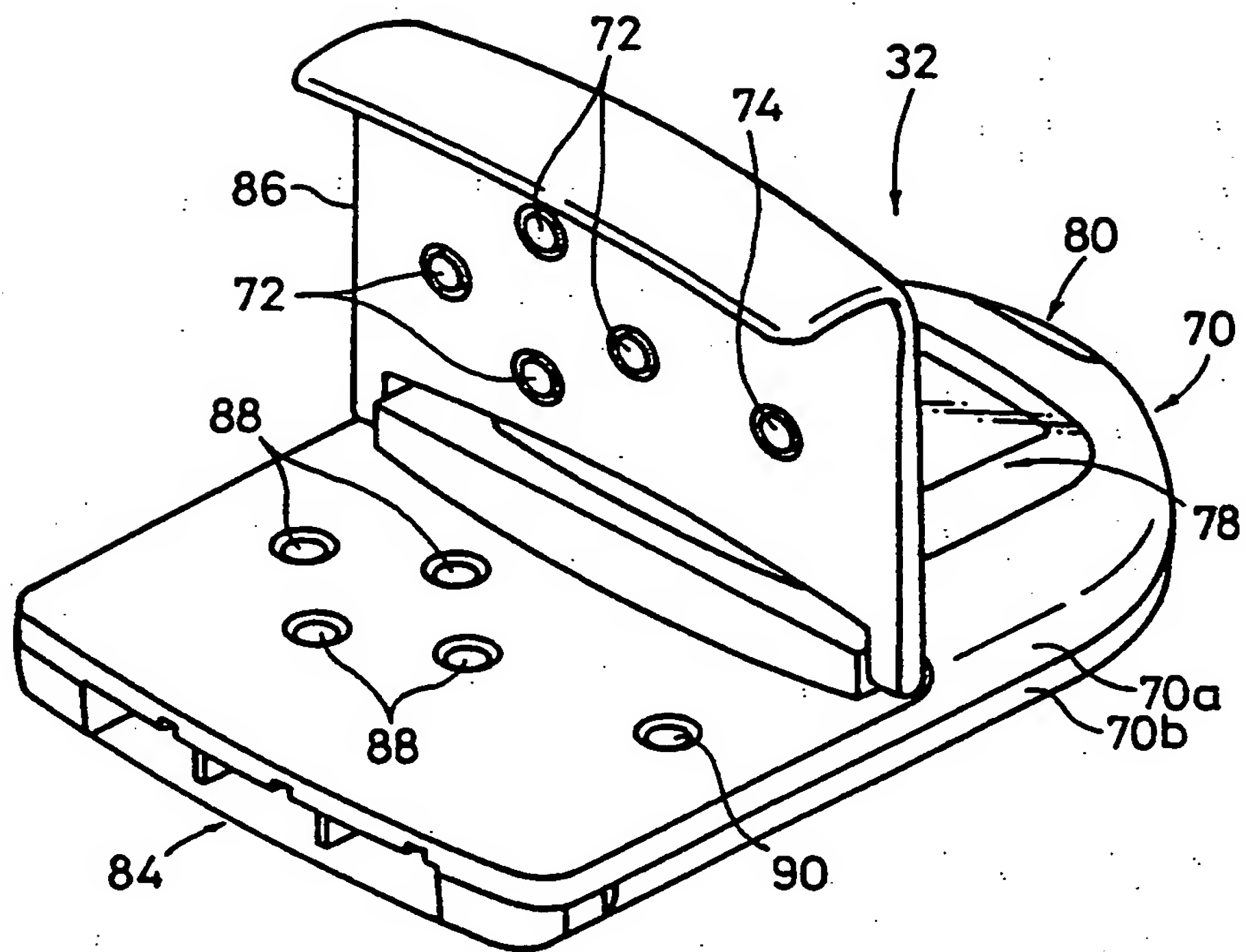


FIG. 7

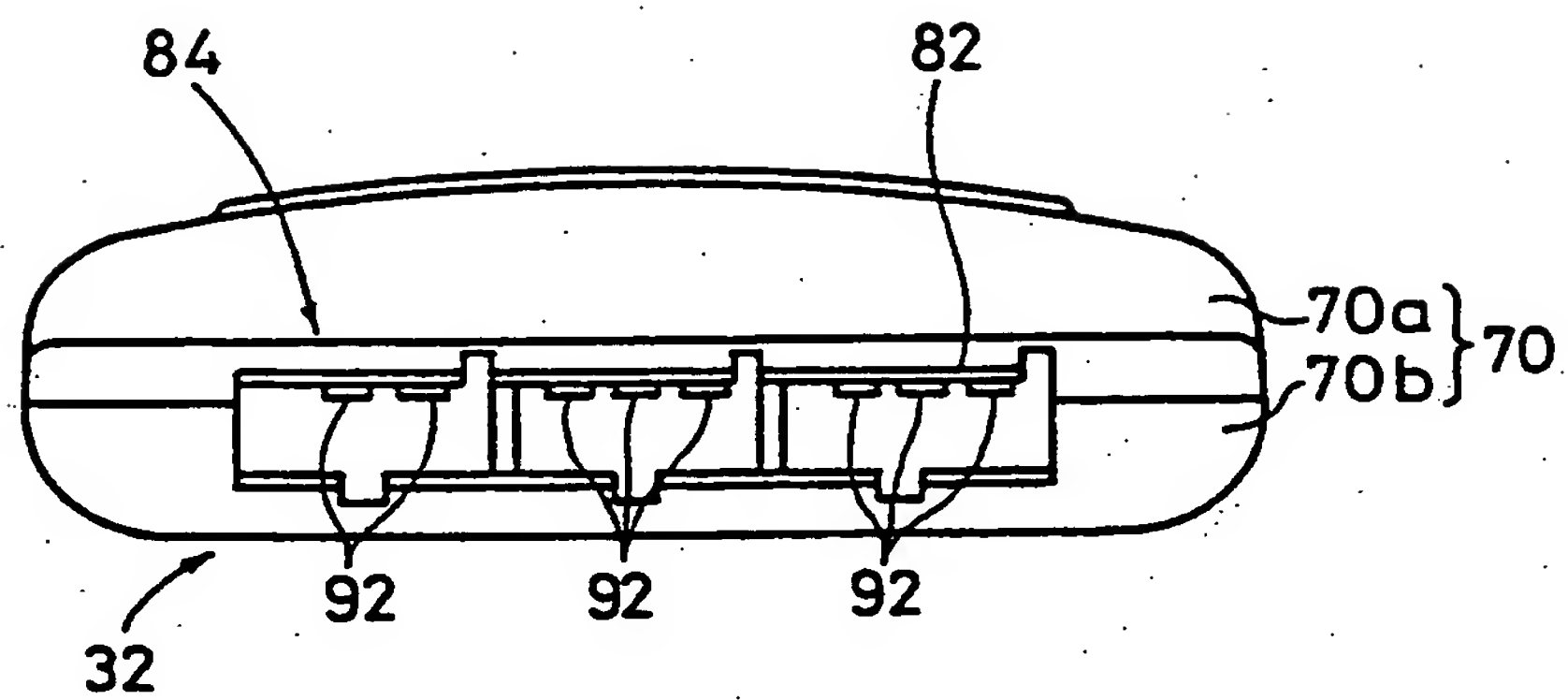


FIG. 8

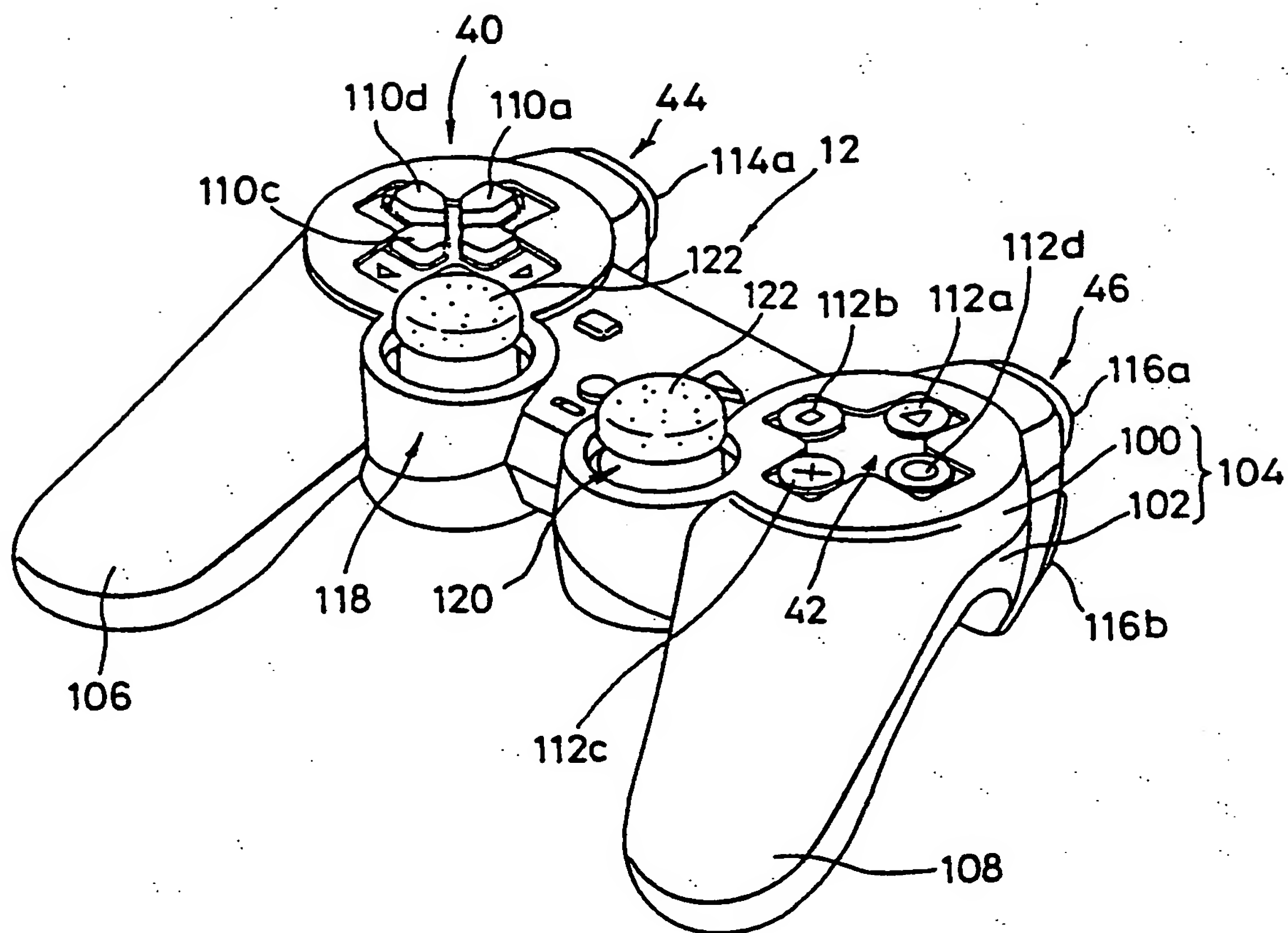


FIG. 9

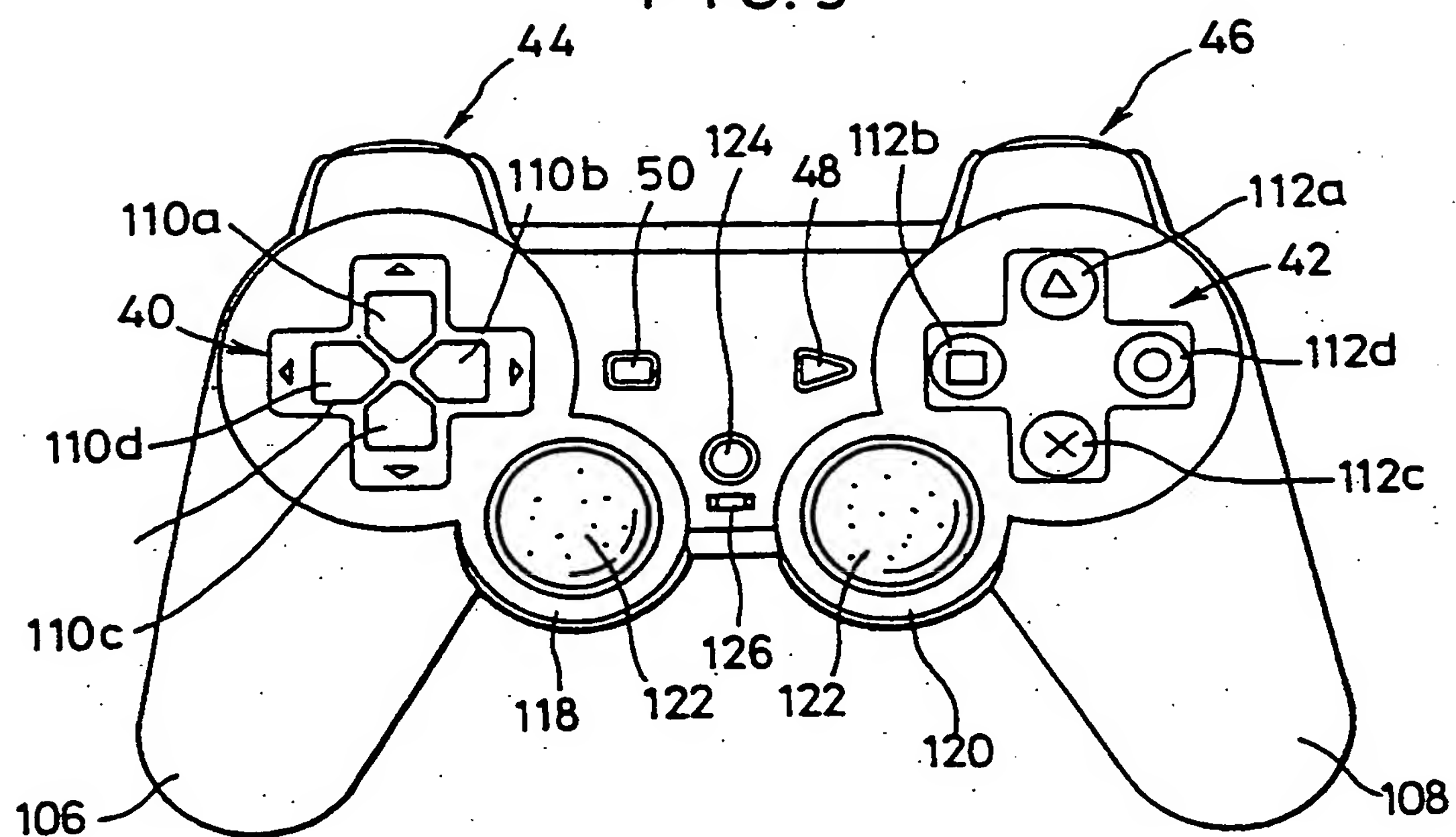
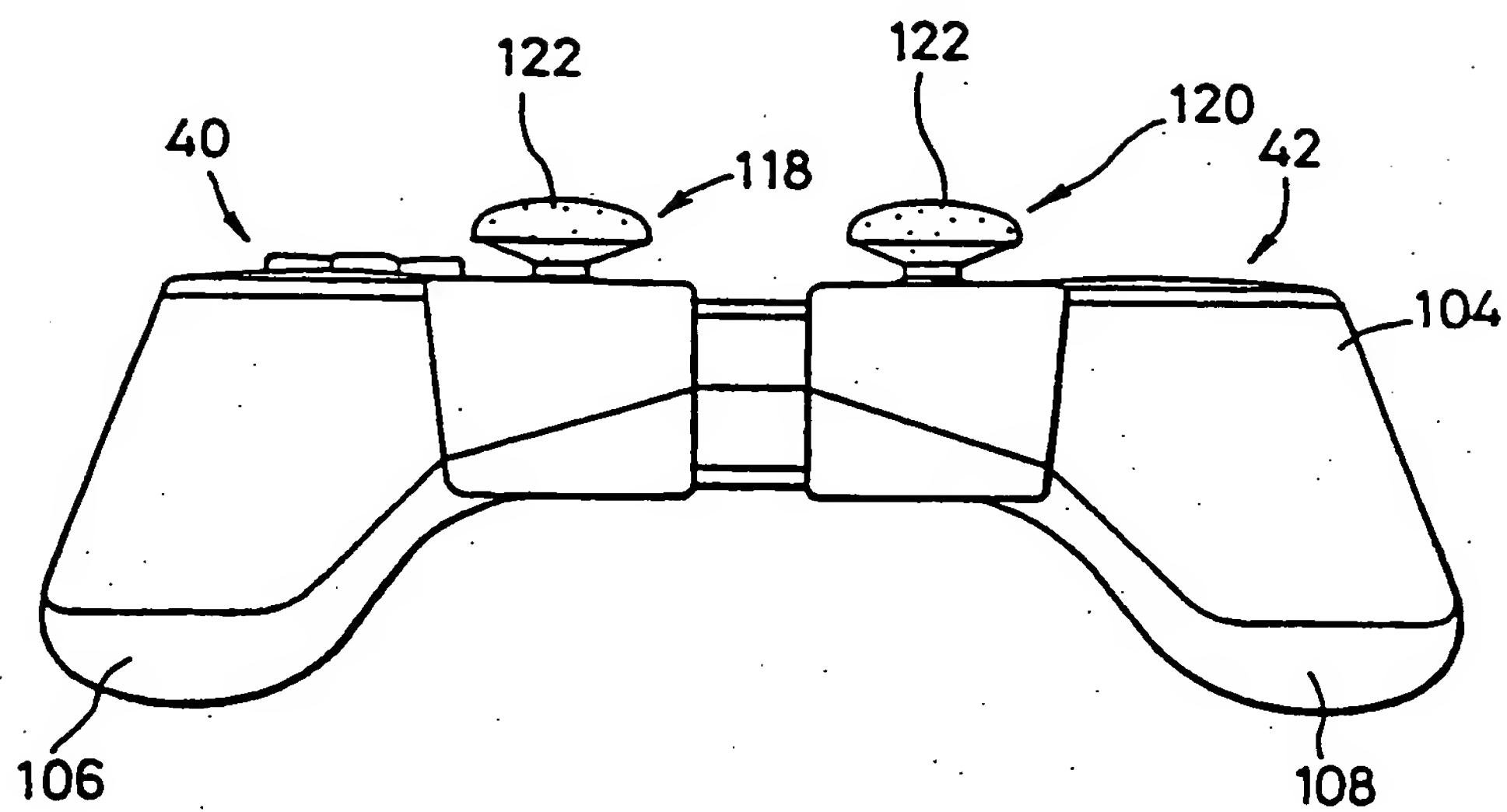
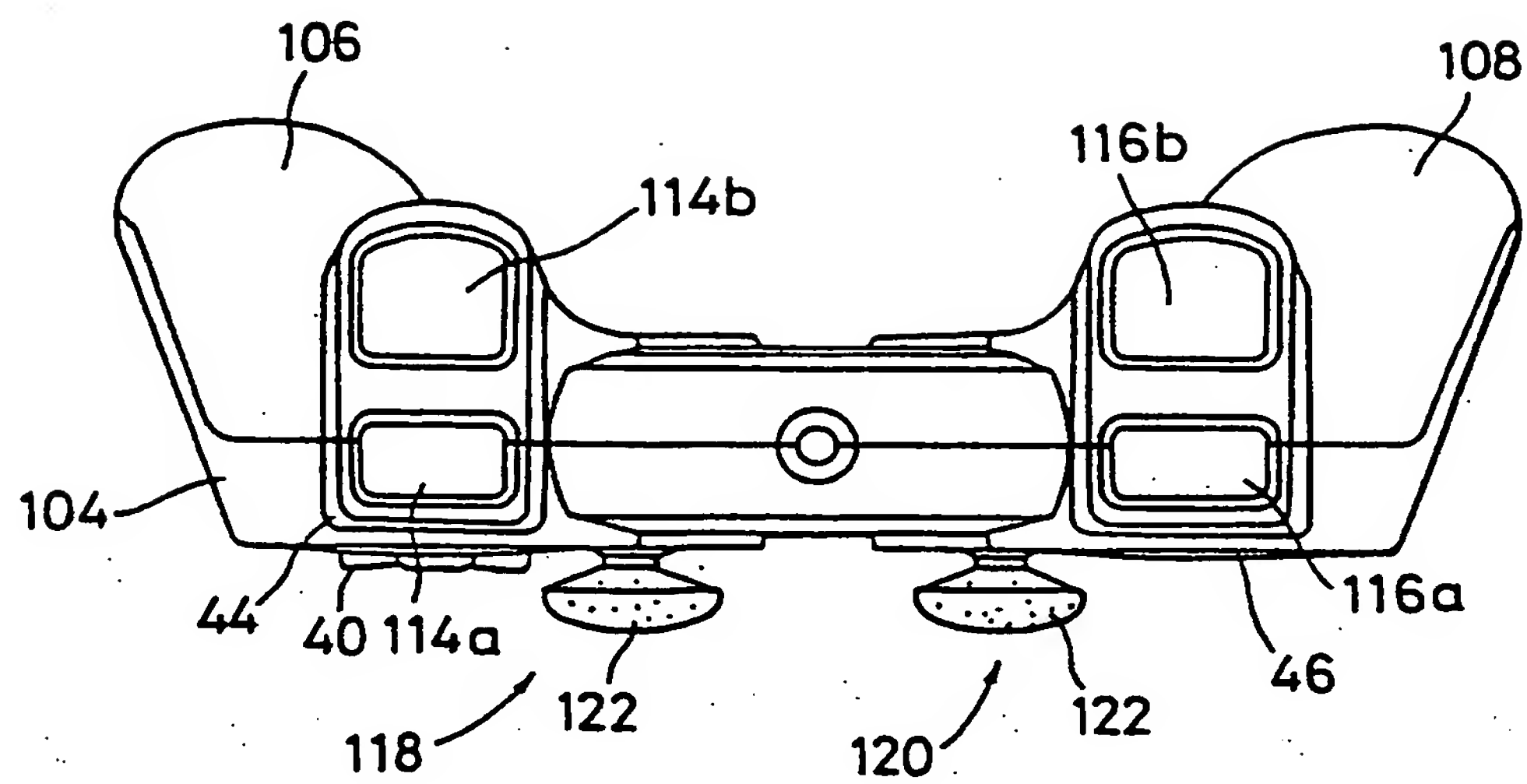


FIG.10



11/43

FIG.11



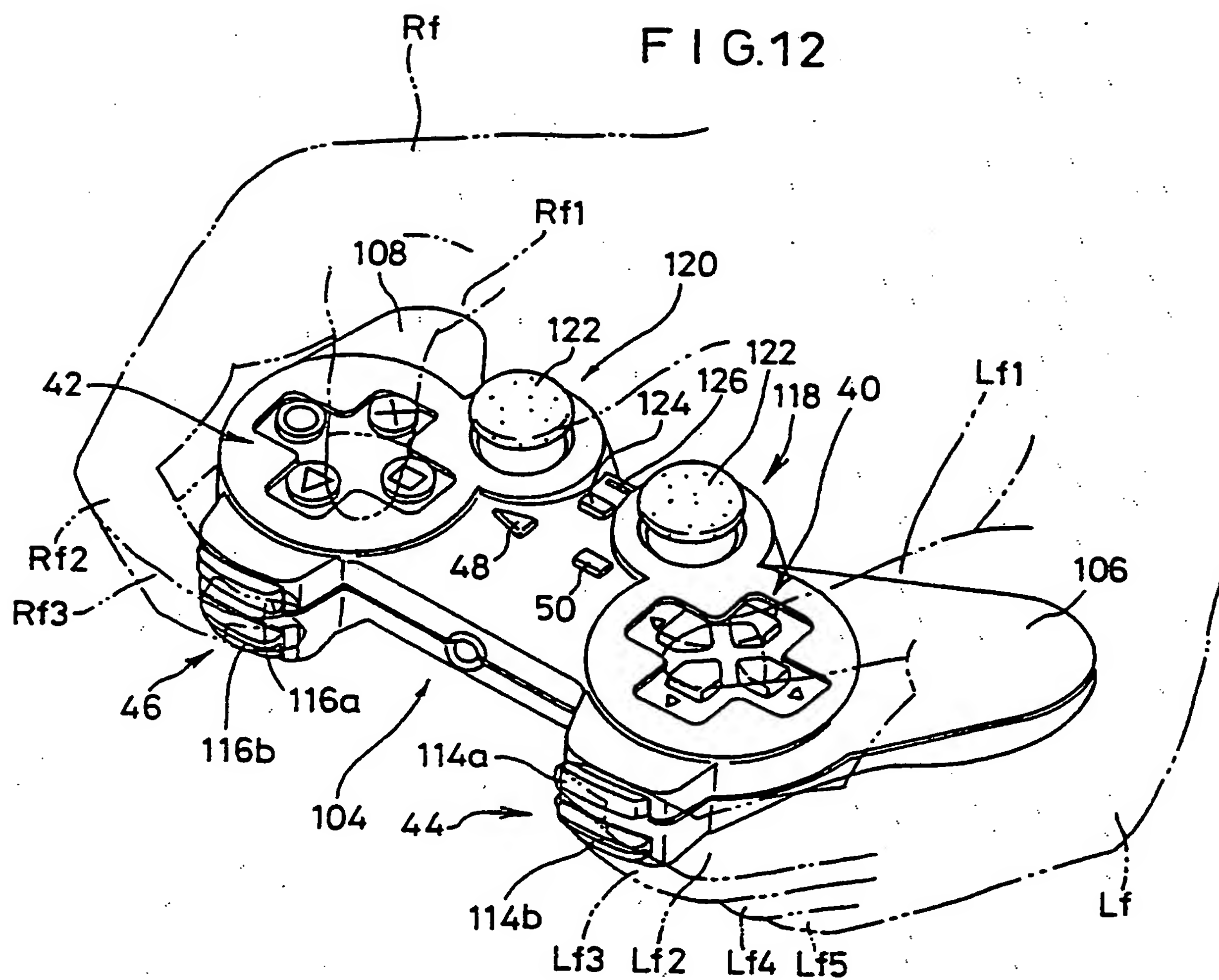


FIG. 13

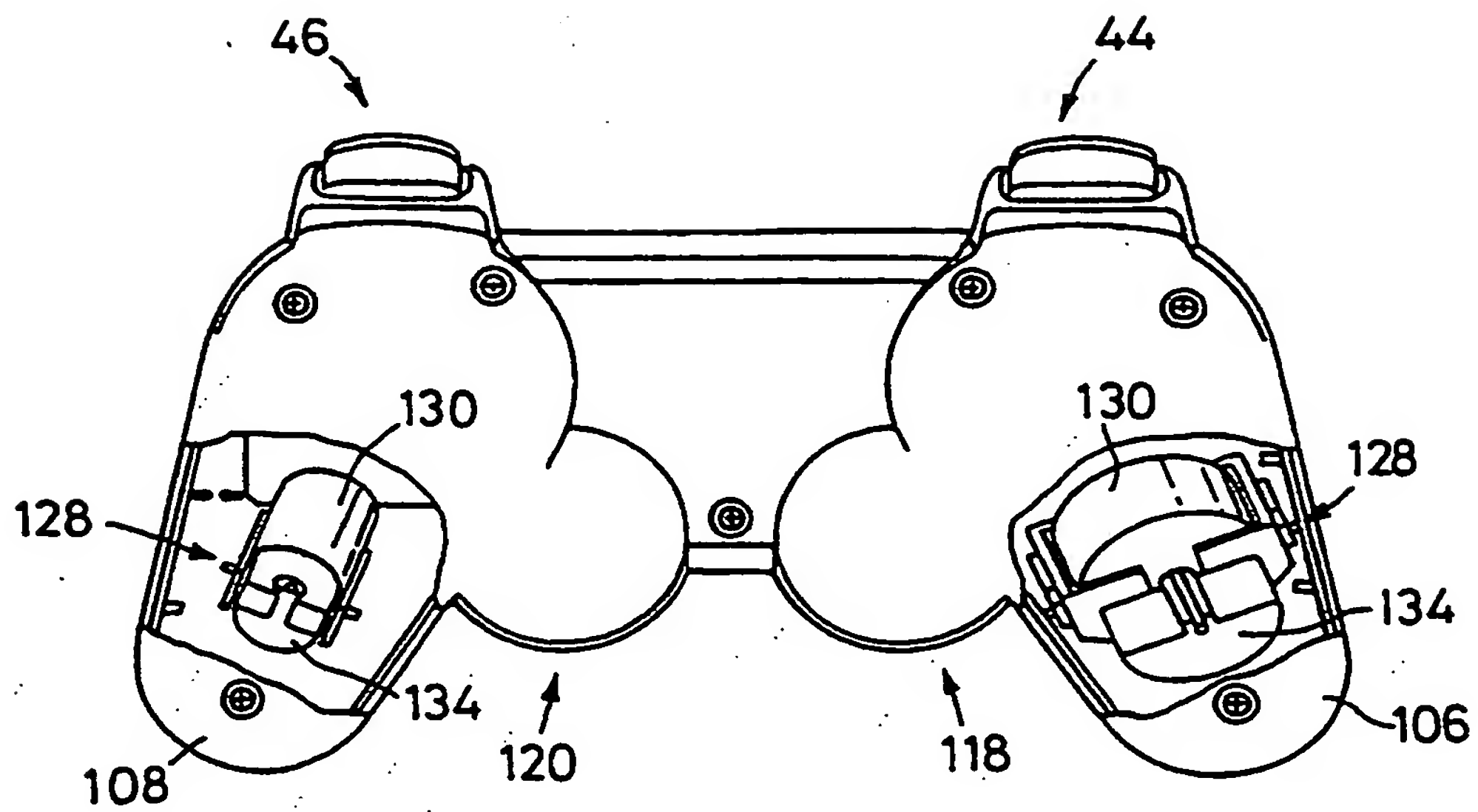


FIG.14

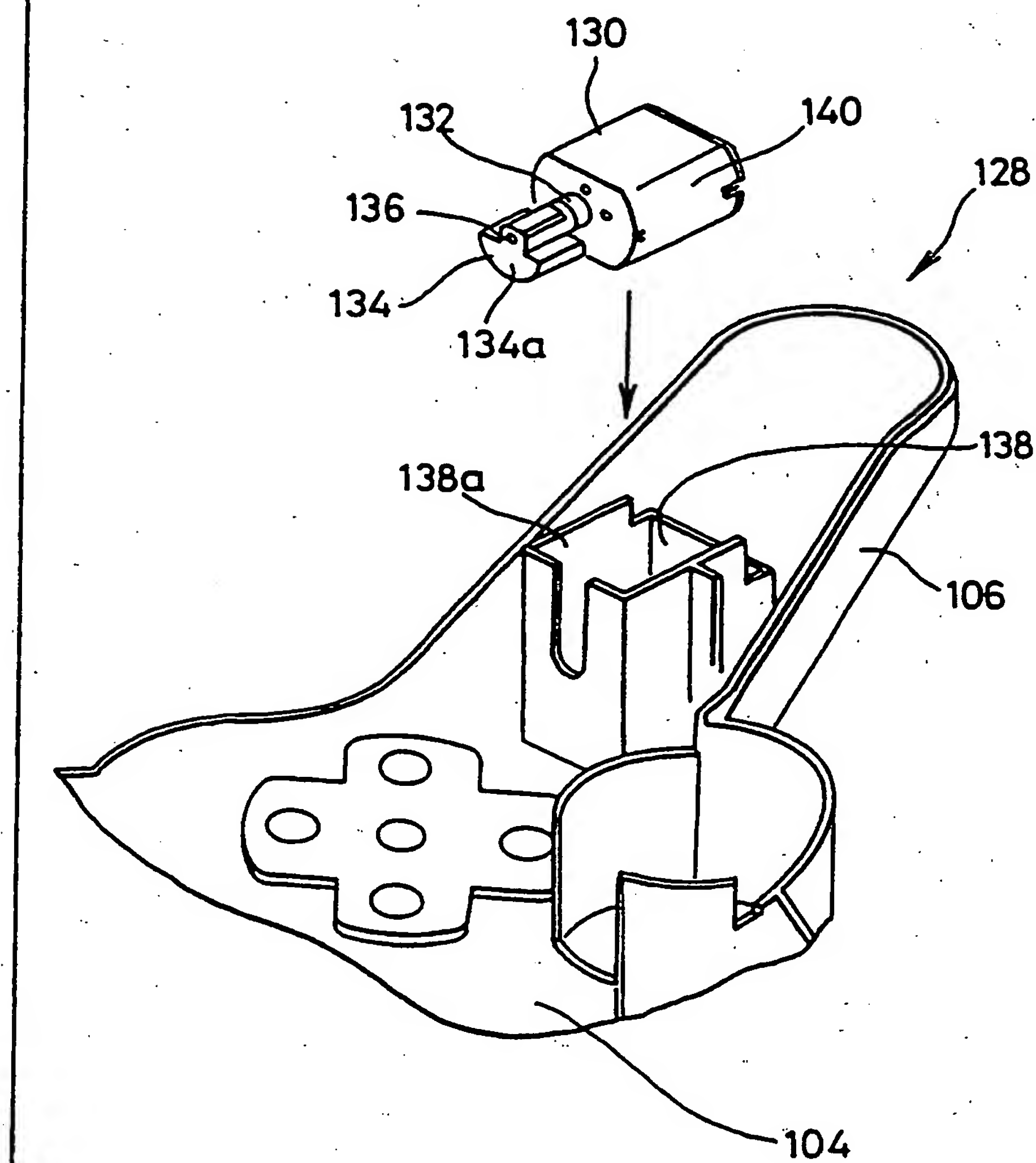


FIG. 15

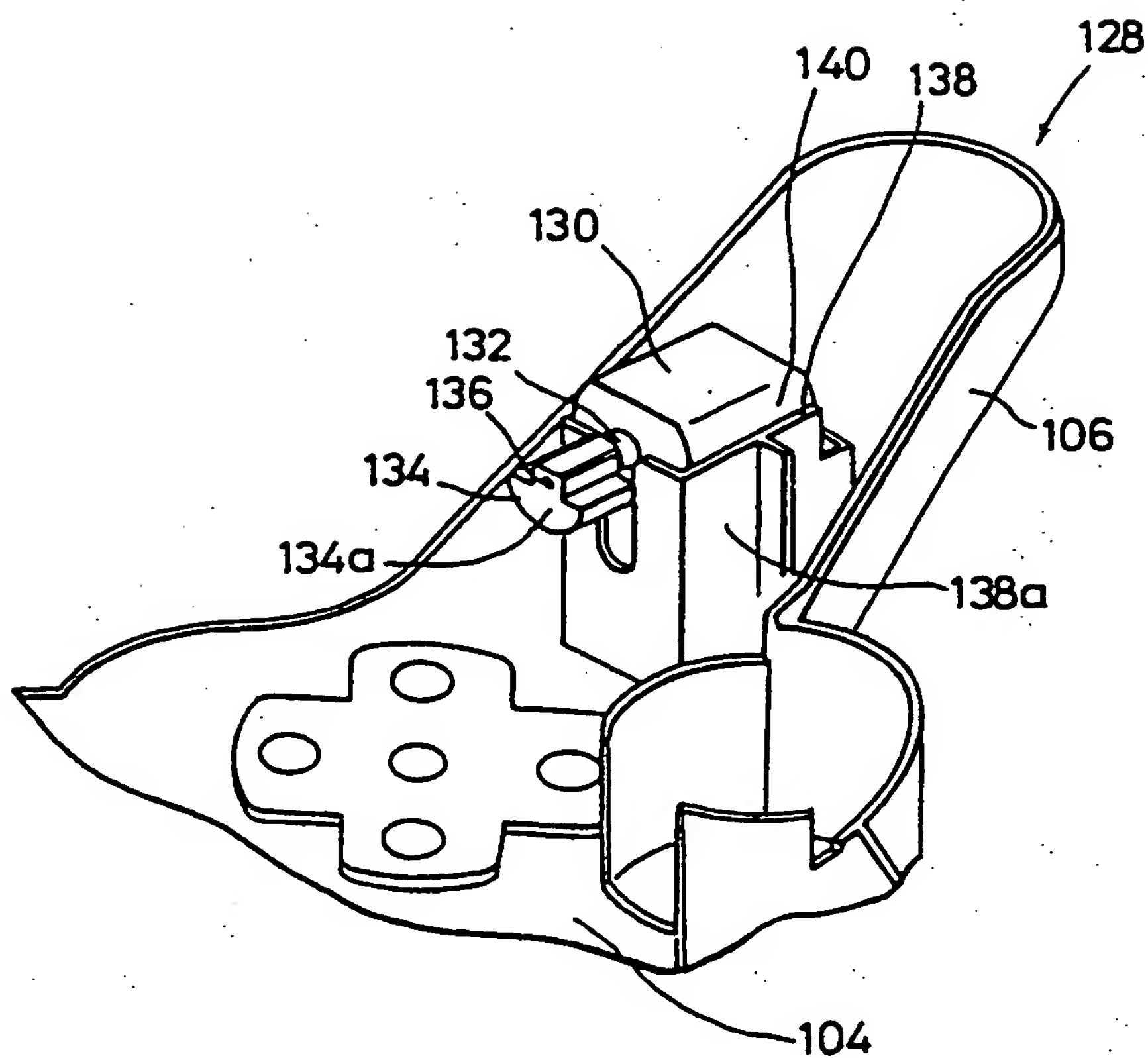


FIG. 16

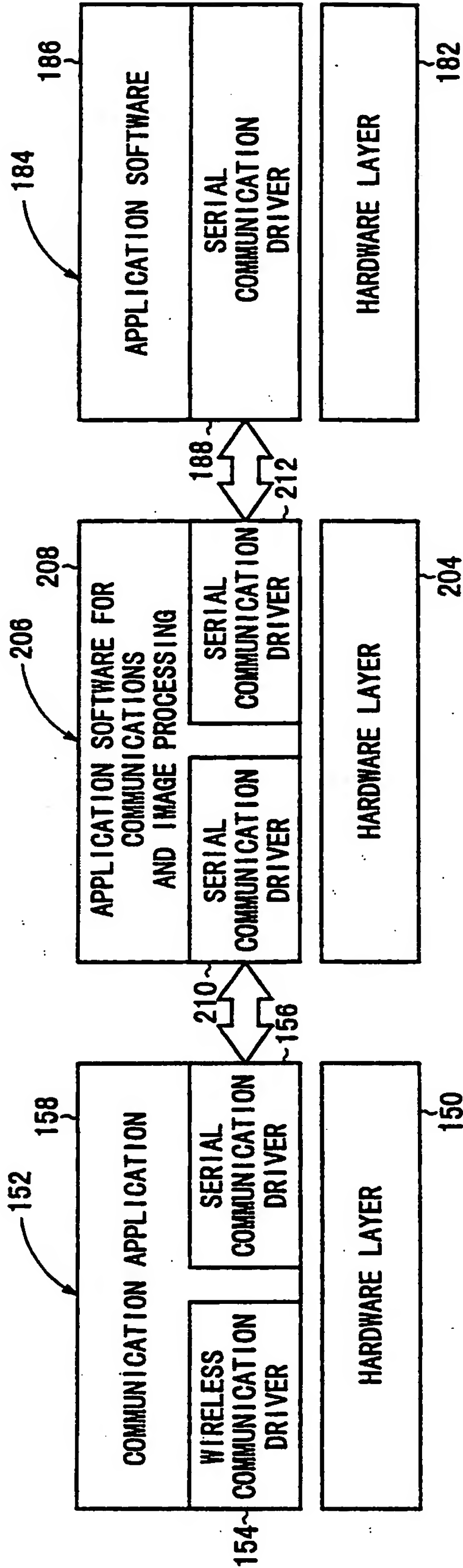
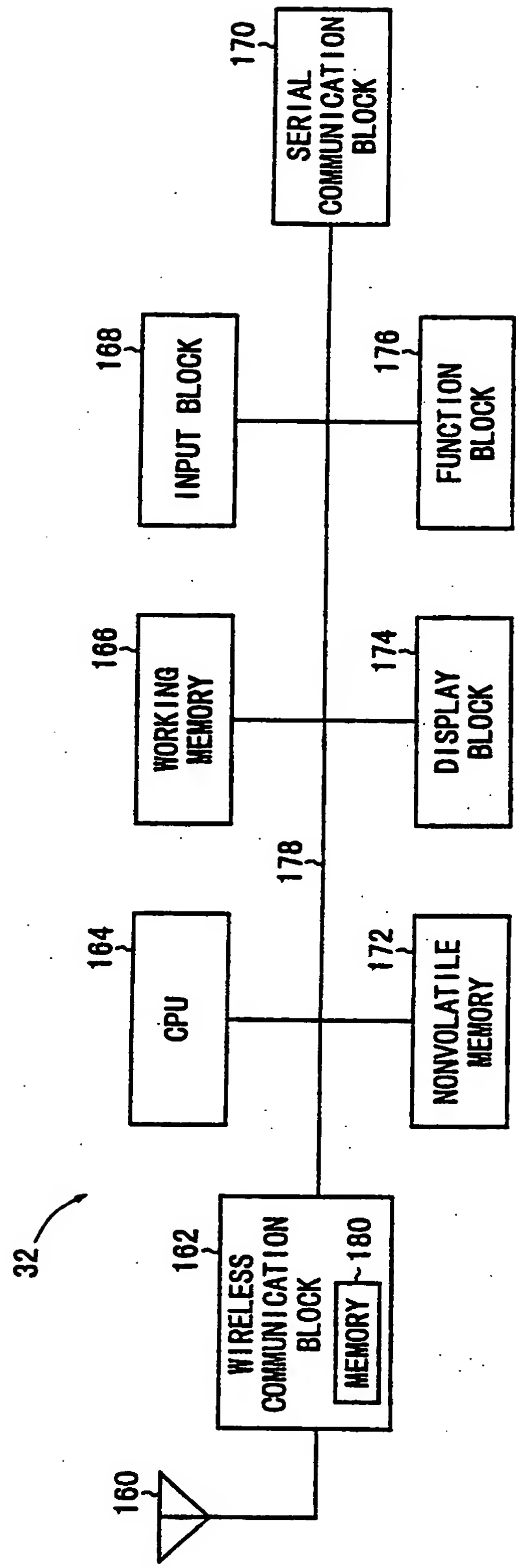
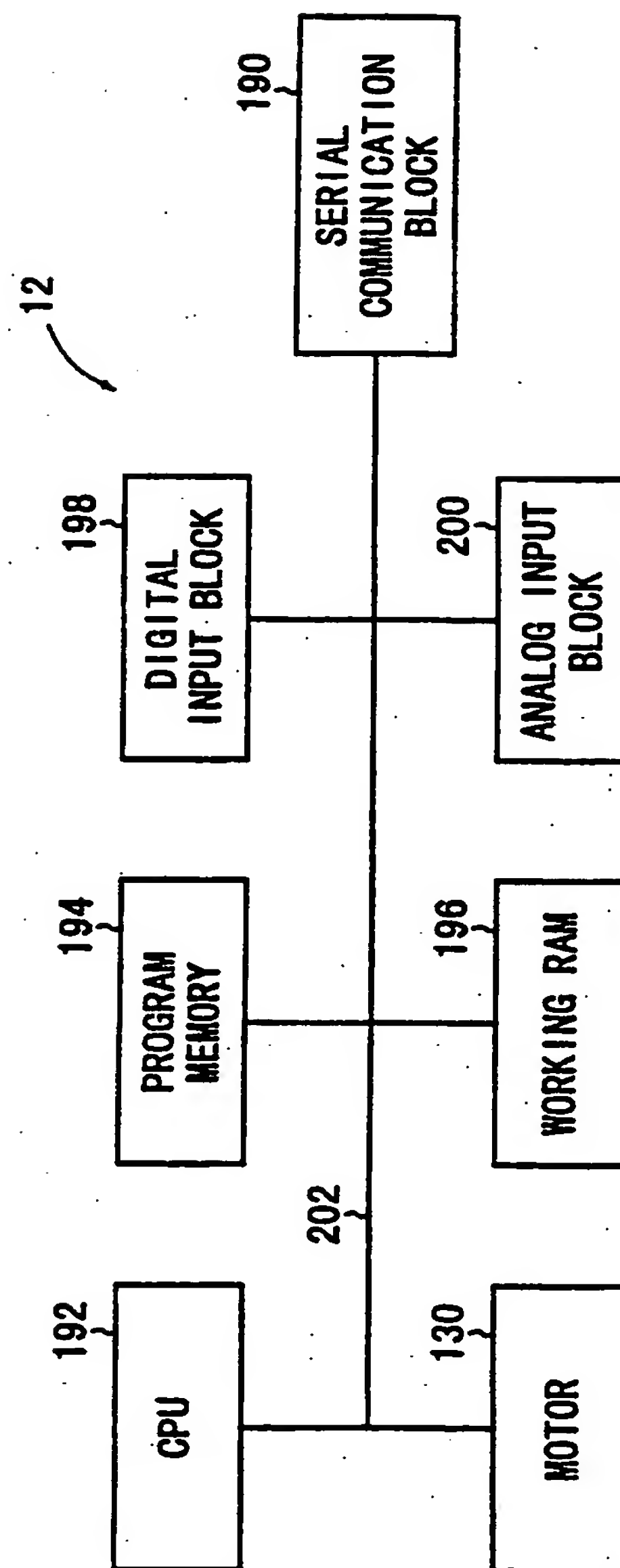


FIG. 17



18/43

FIG. 18



19/43

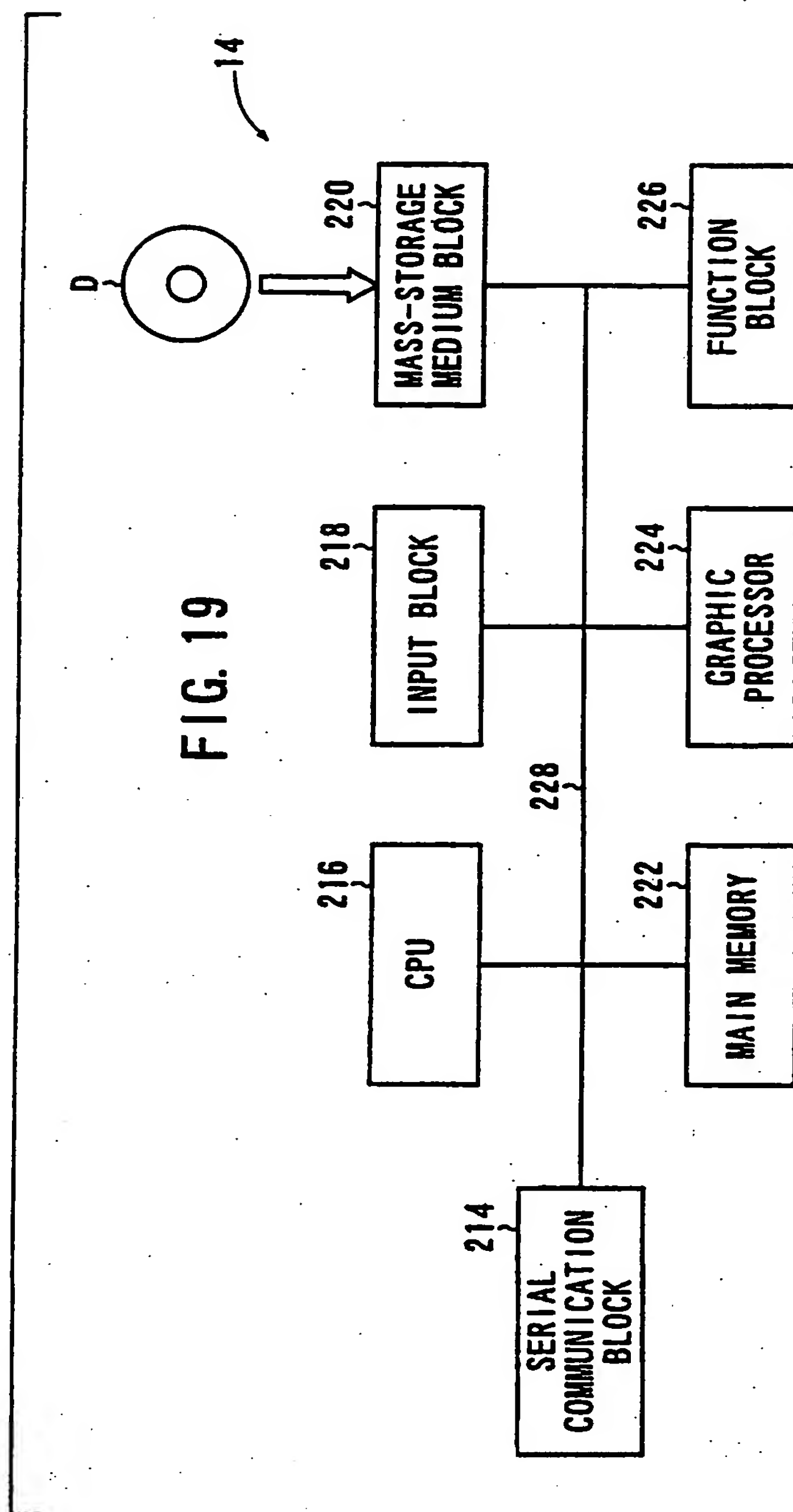
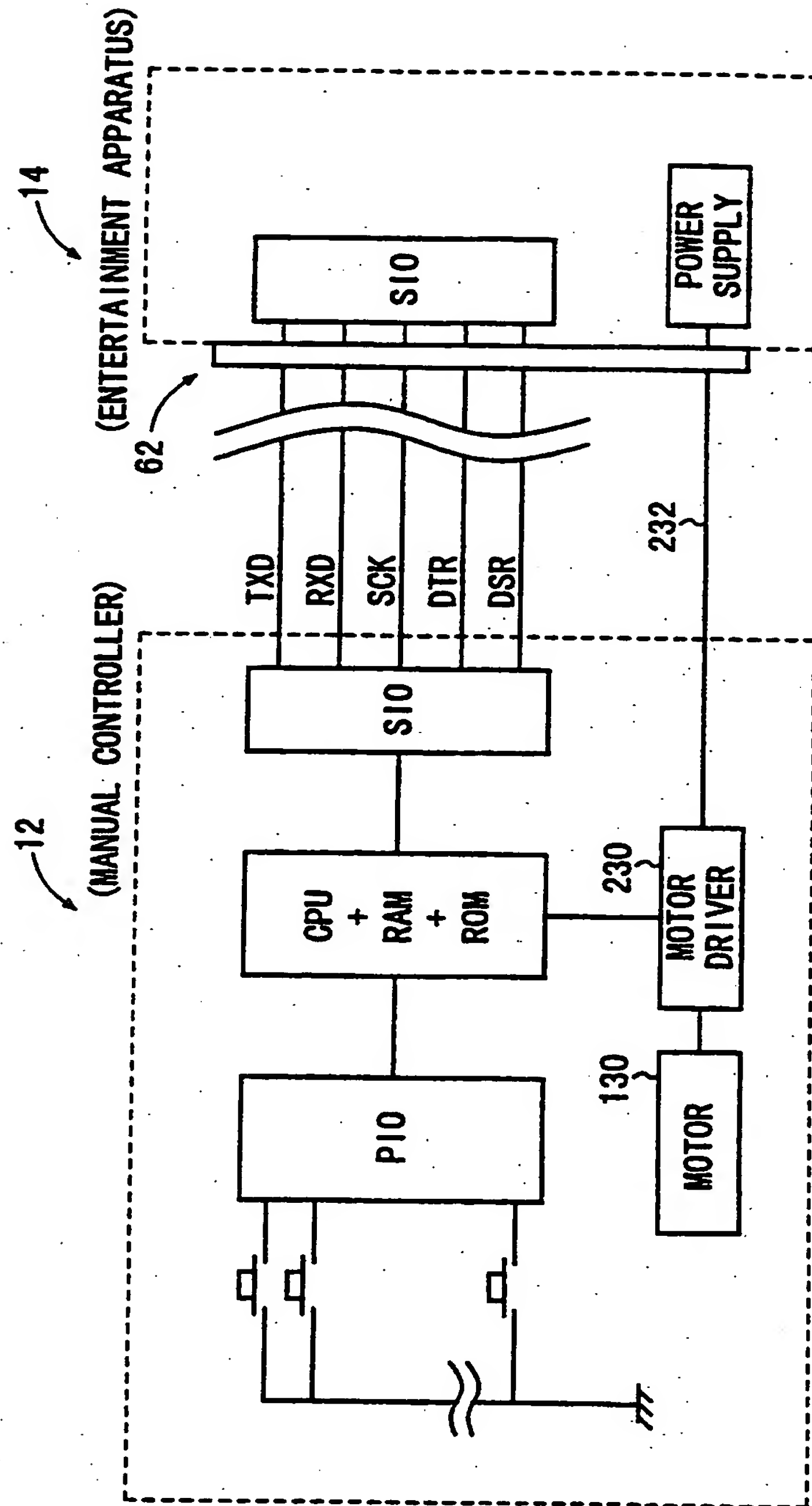


FIG. 20



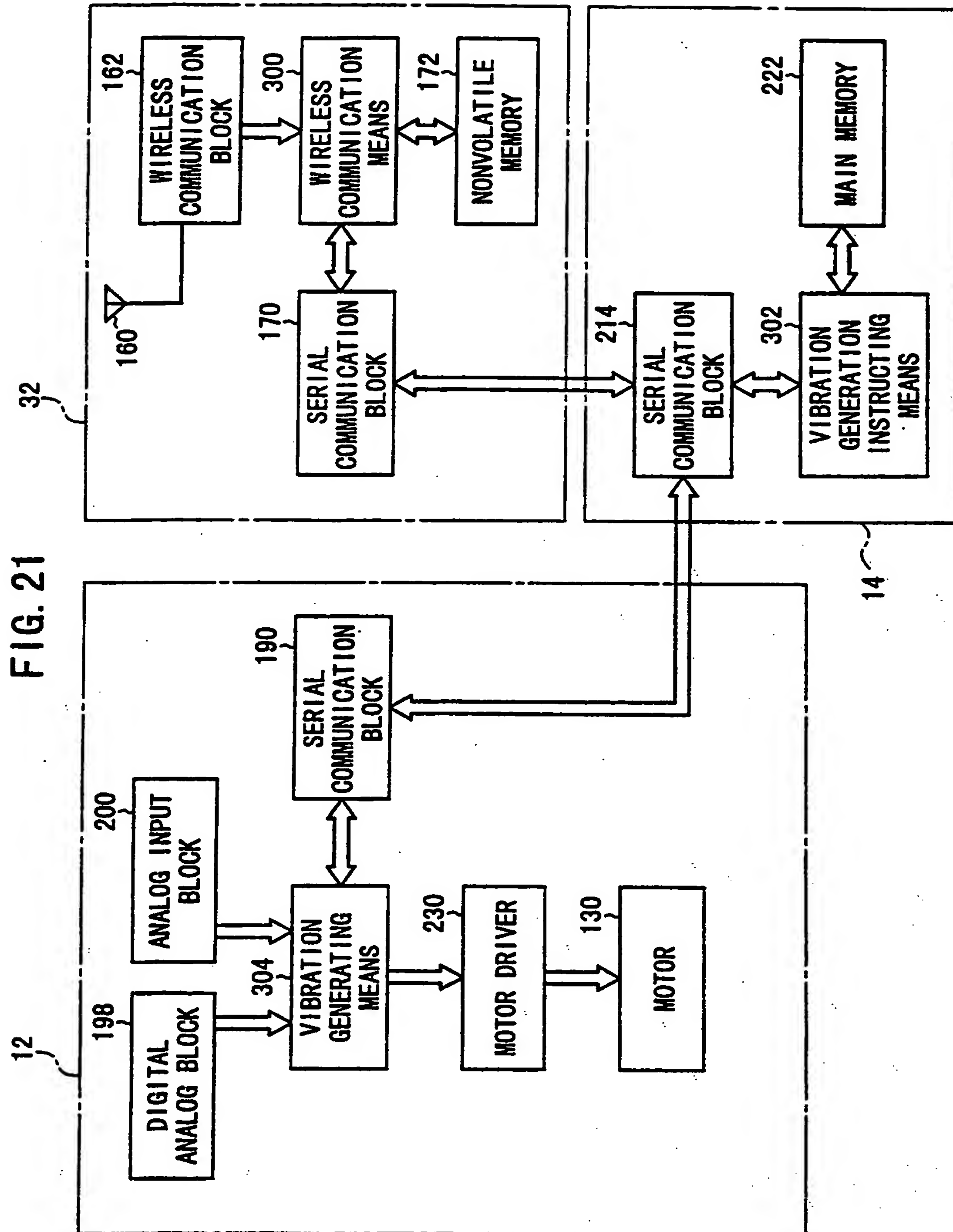


FIG. 22

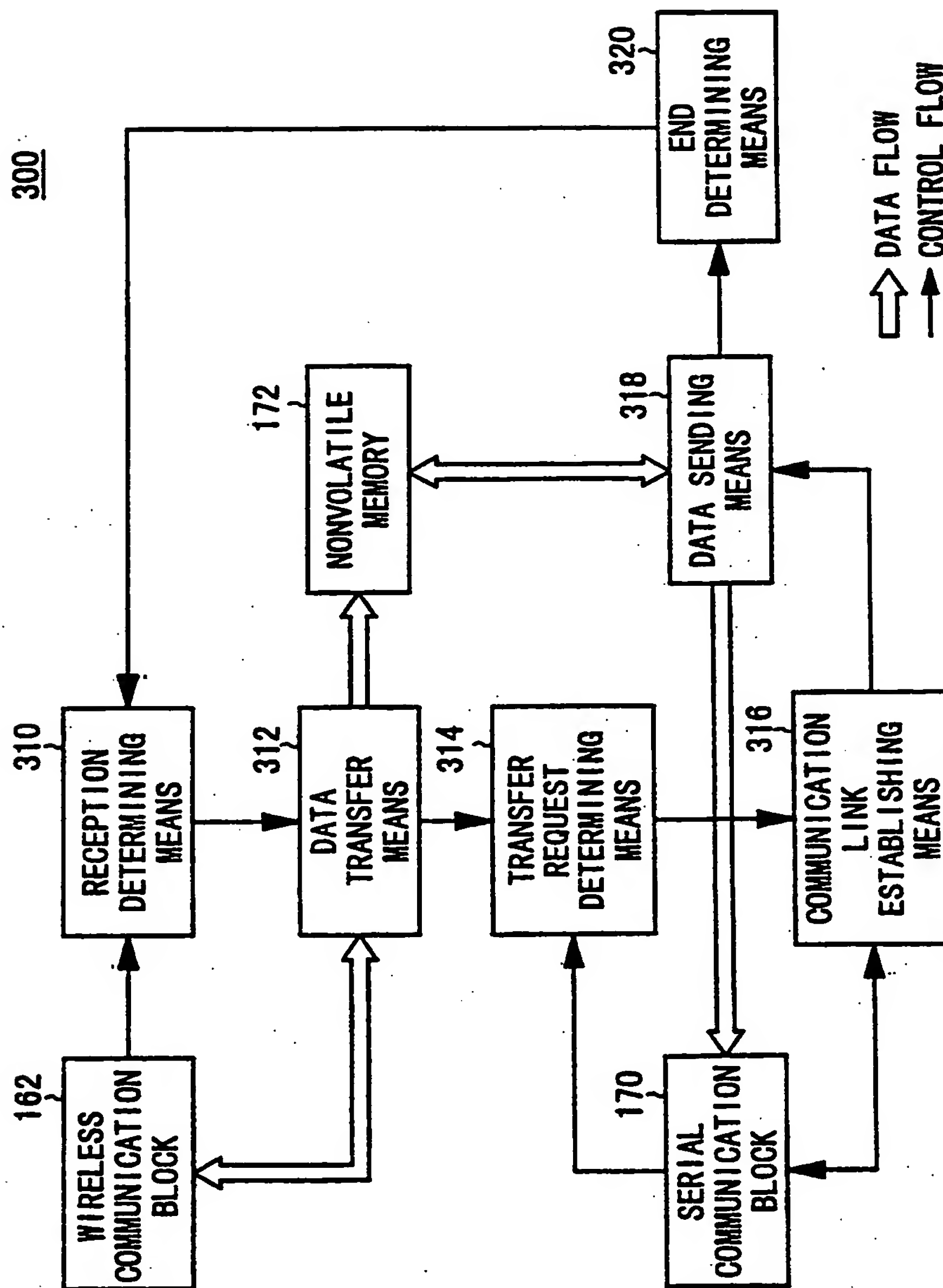


FIG. 23A



FIG. 23B



FIG. 23C

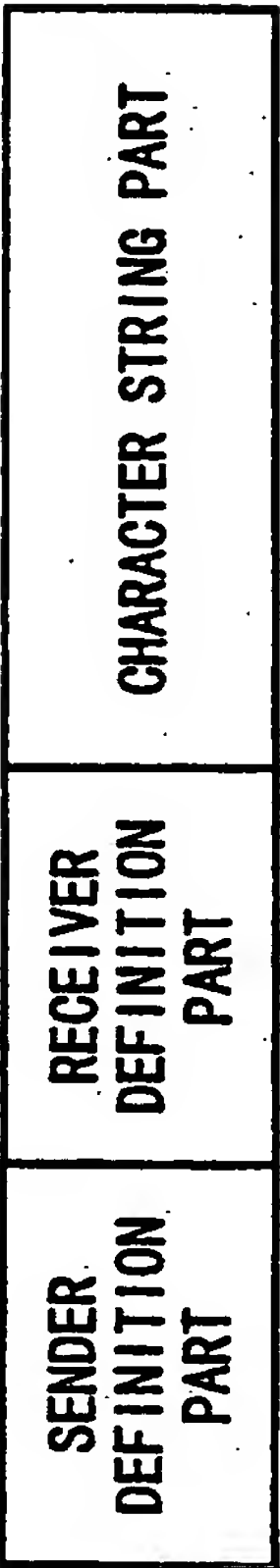


FIG. 23D

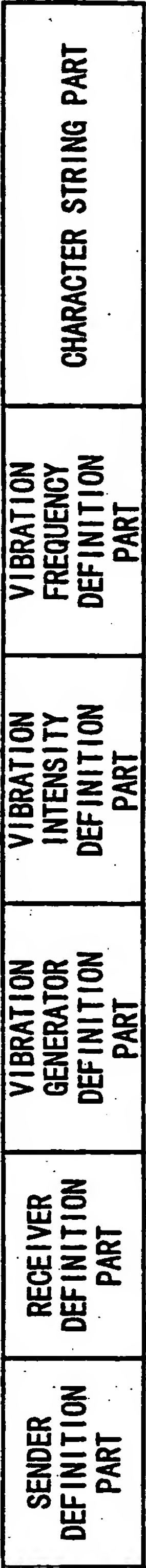


FIG. 24

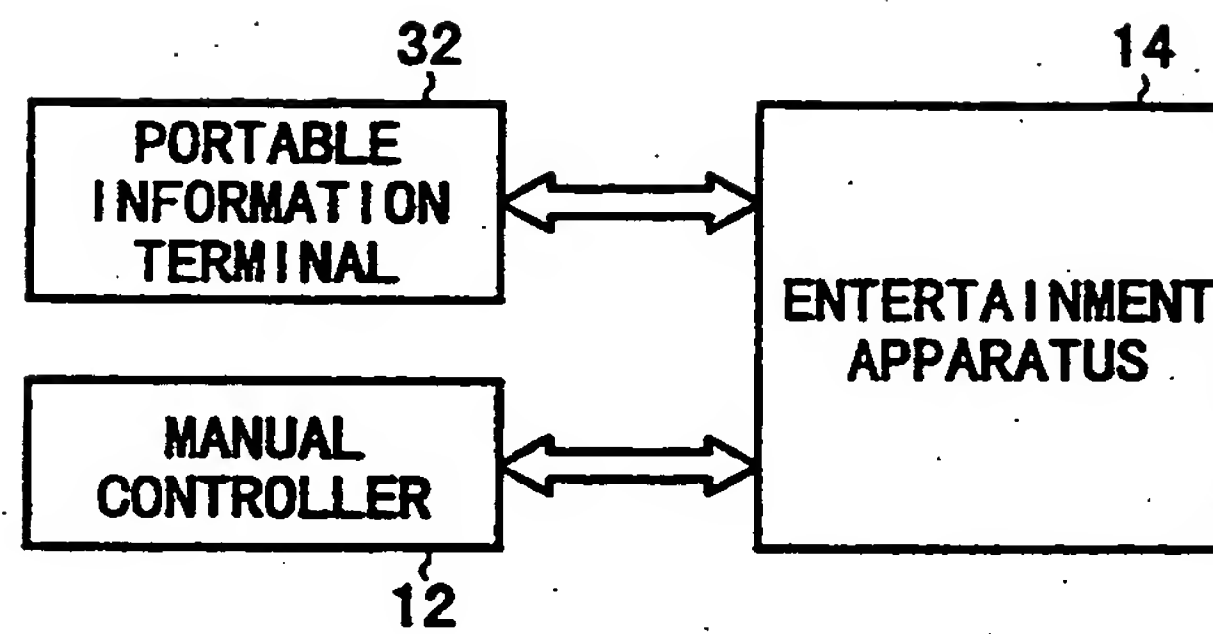


FIG. 25

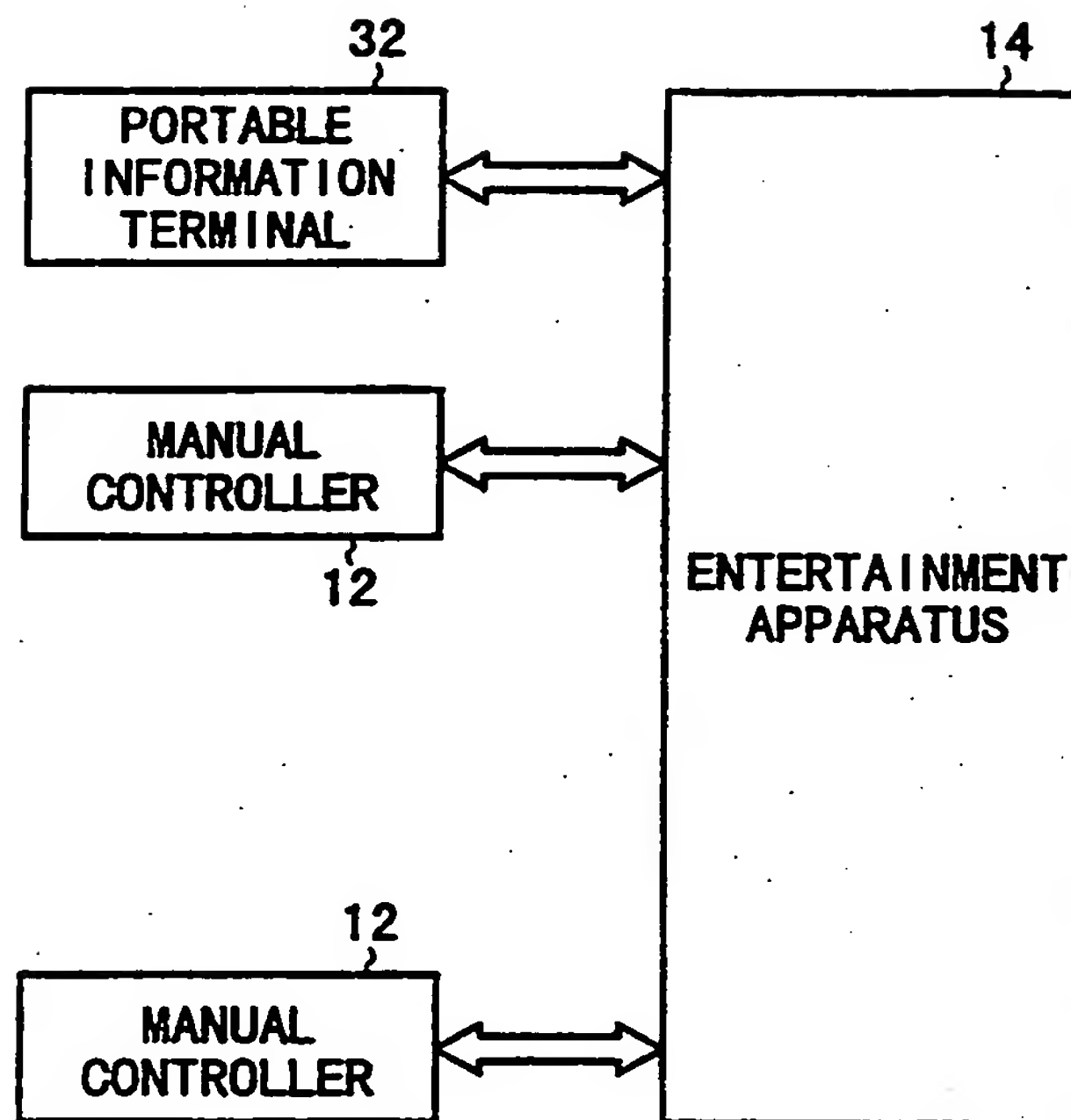


FIG. 26

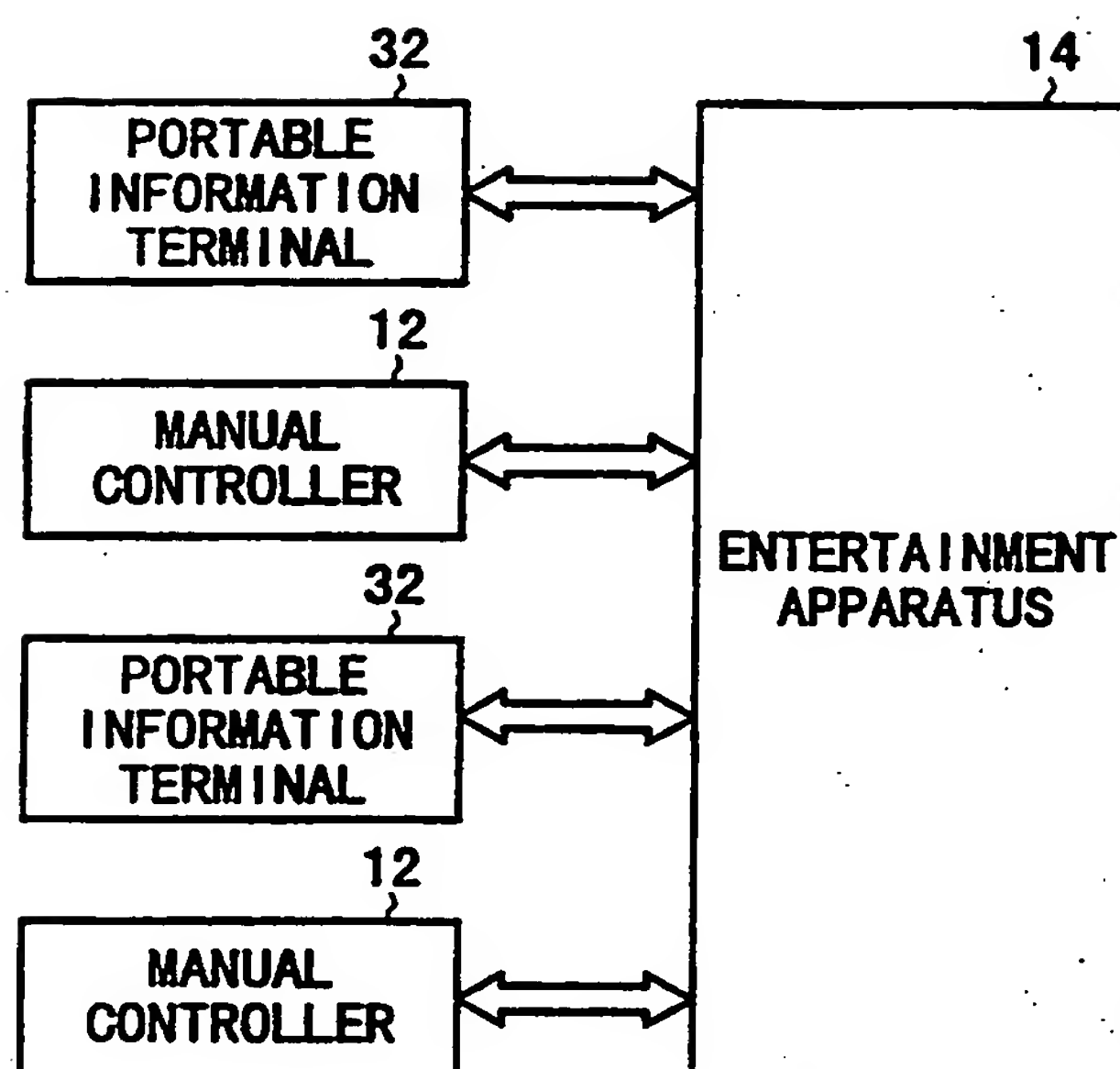


FIG. 27

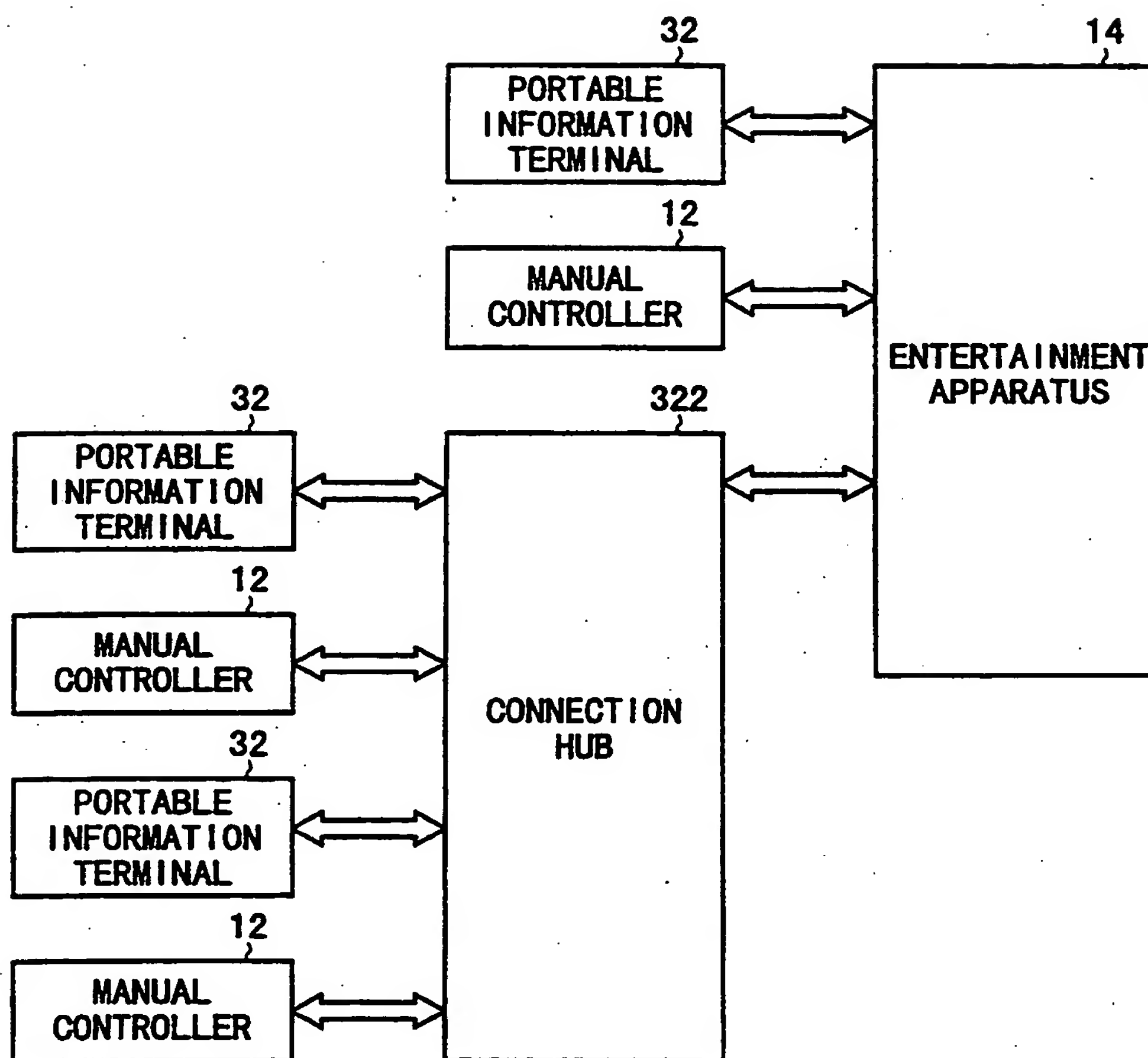


FIG. 28

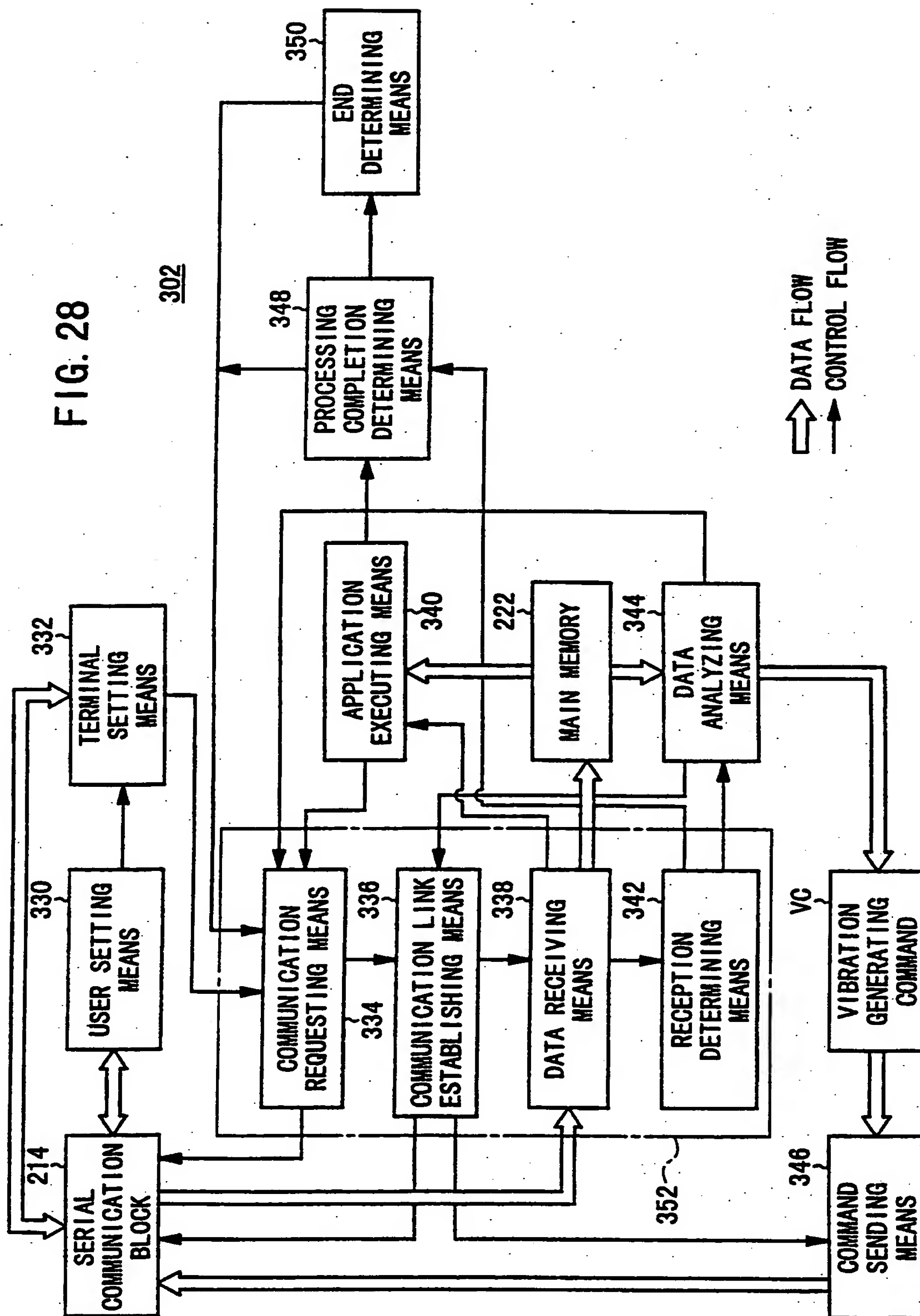


FIG. 29

USER INFORMATION TABLE

RECORD 1	IDENTIFICATION CODE	PORT NUMBER
RECORD 2	IDENTIFICATION CODE	PORT NUMBER
RECORD 3	IDENTIFICATION CODE	PORT NUMBER
•	•	
•	•	
•	•	
•	•	

FIG. 30

TERMINAL INFORMATION TABLE

RECORD 1	PORT NUMBER
RECORD 2	PORT NUMBER
RECORD 3	PORT NUMBER
⋮	⋮

FIG. 31

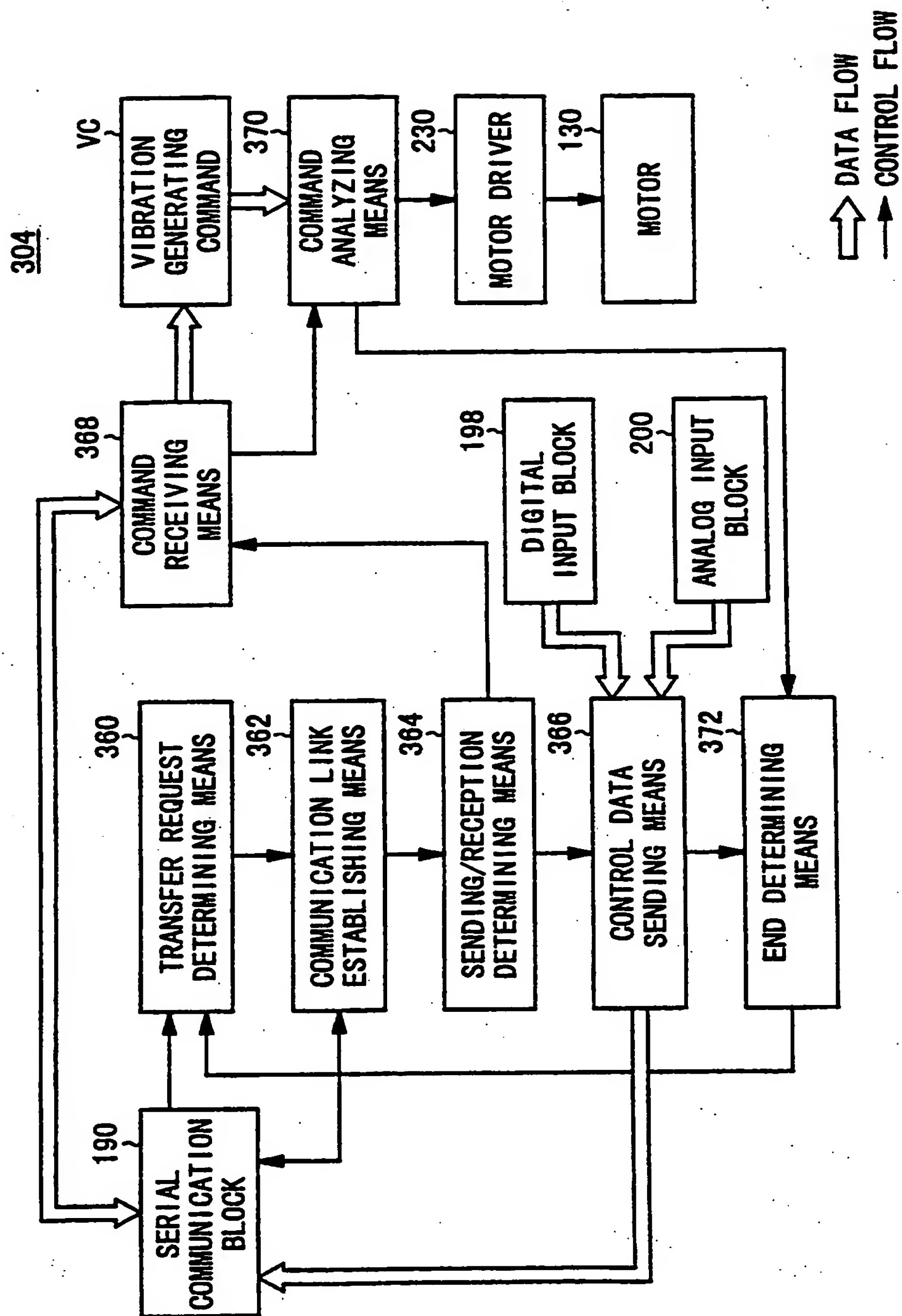


FIG. 32

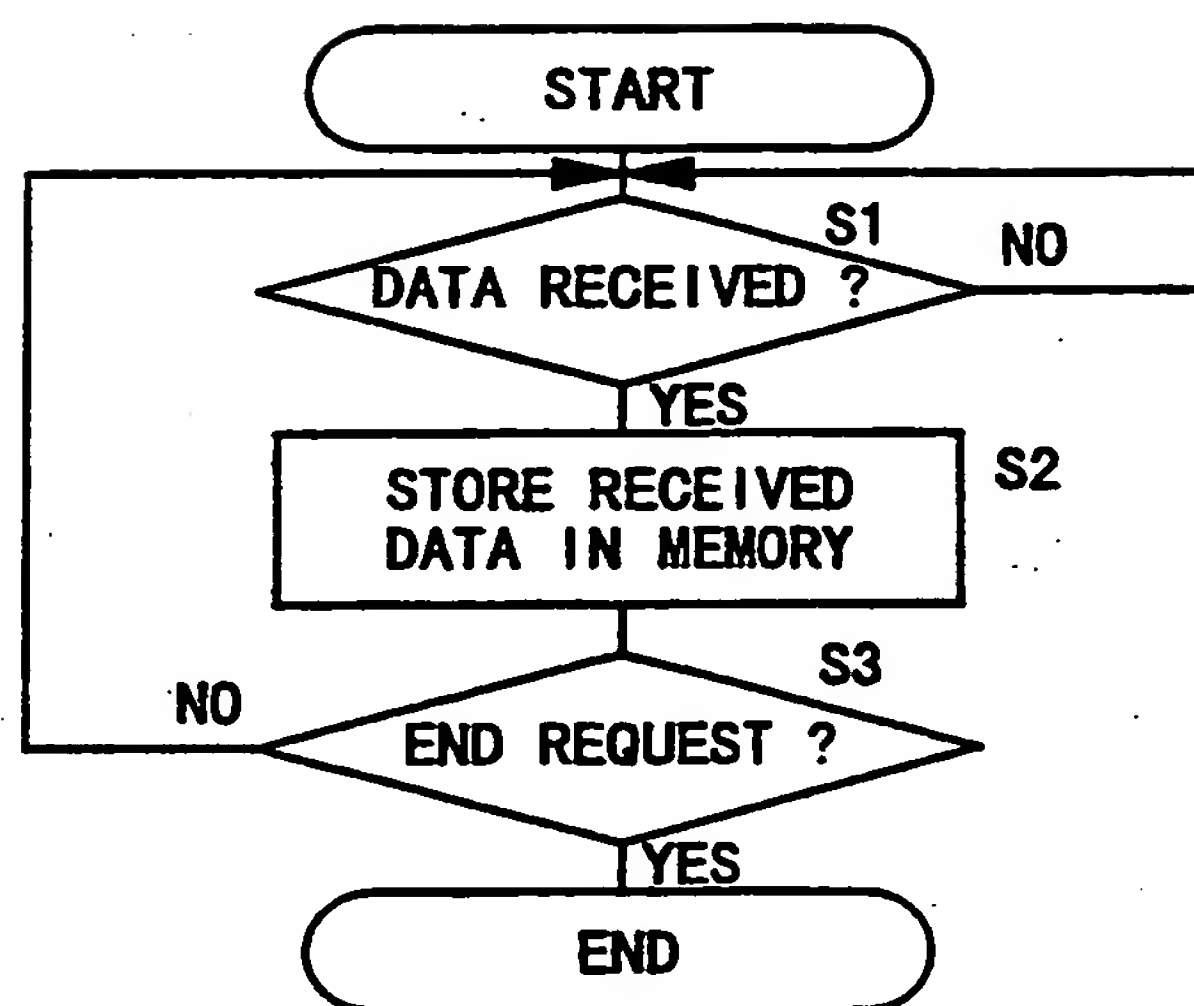


FIG. 33

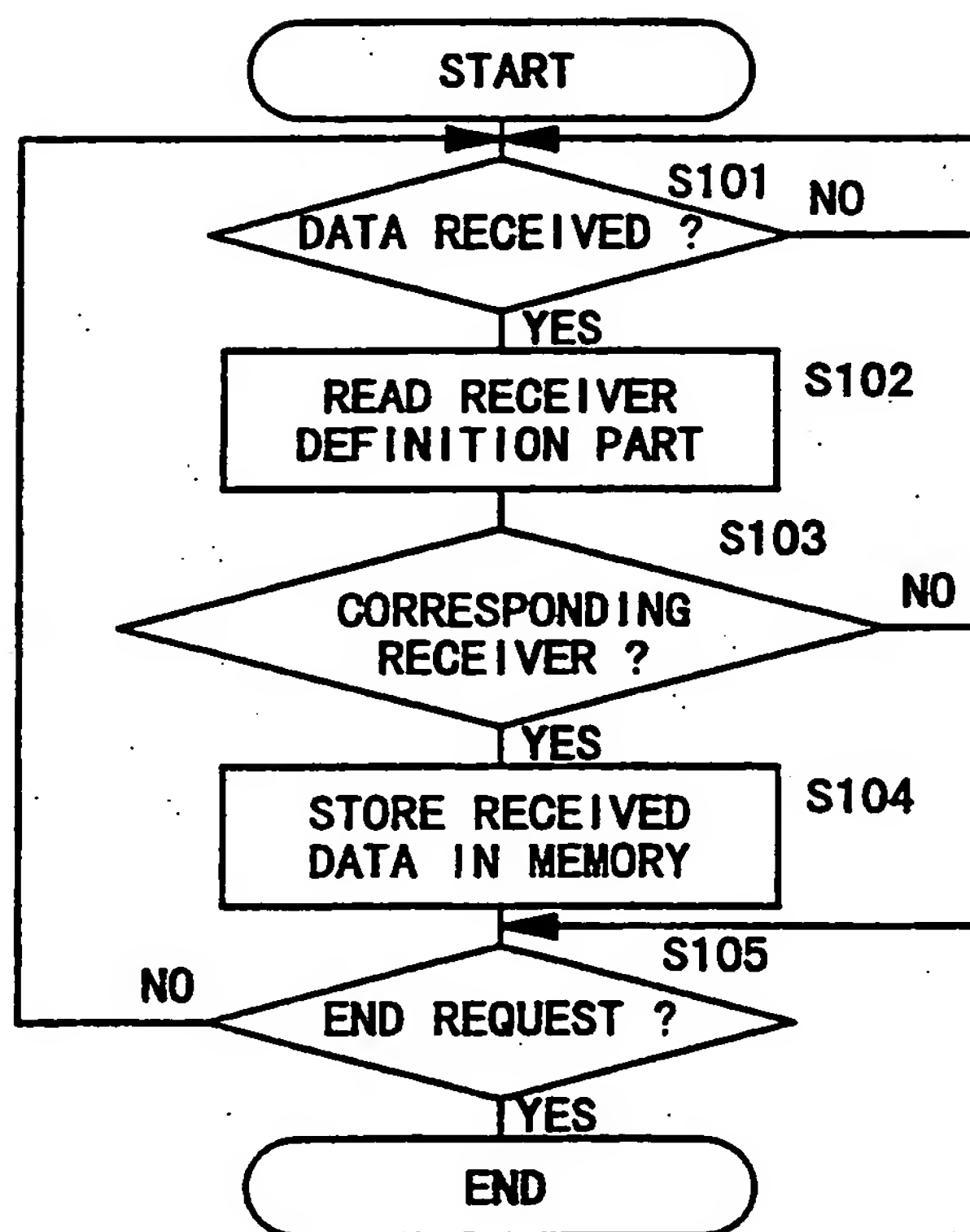
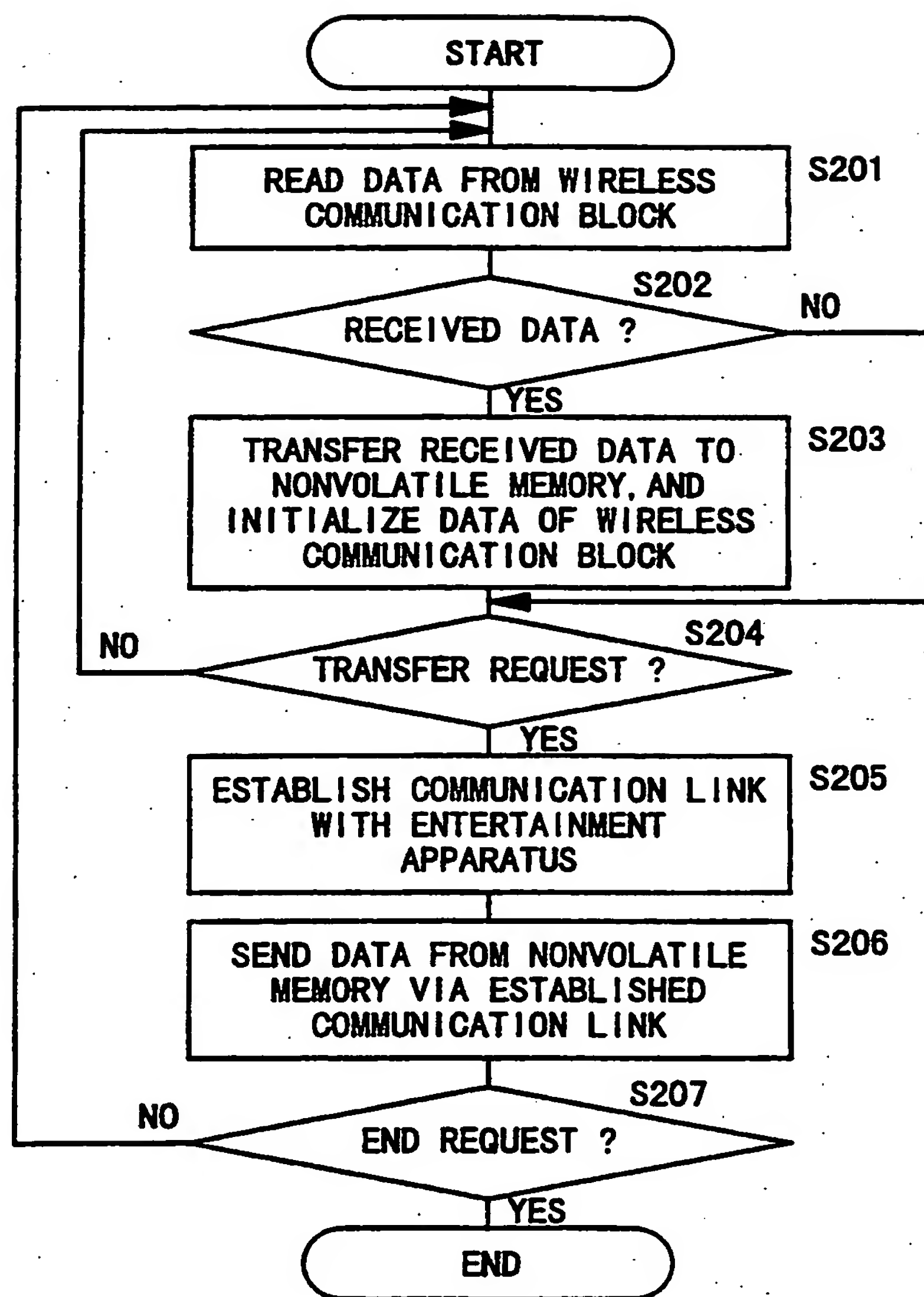
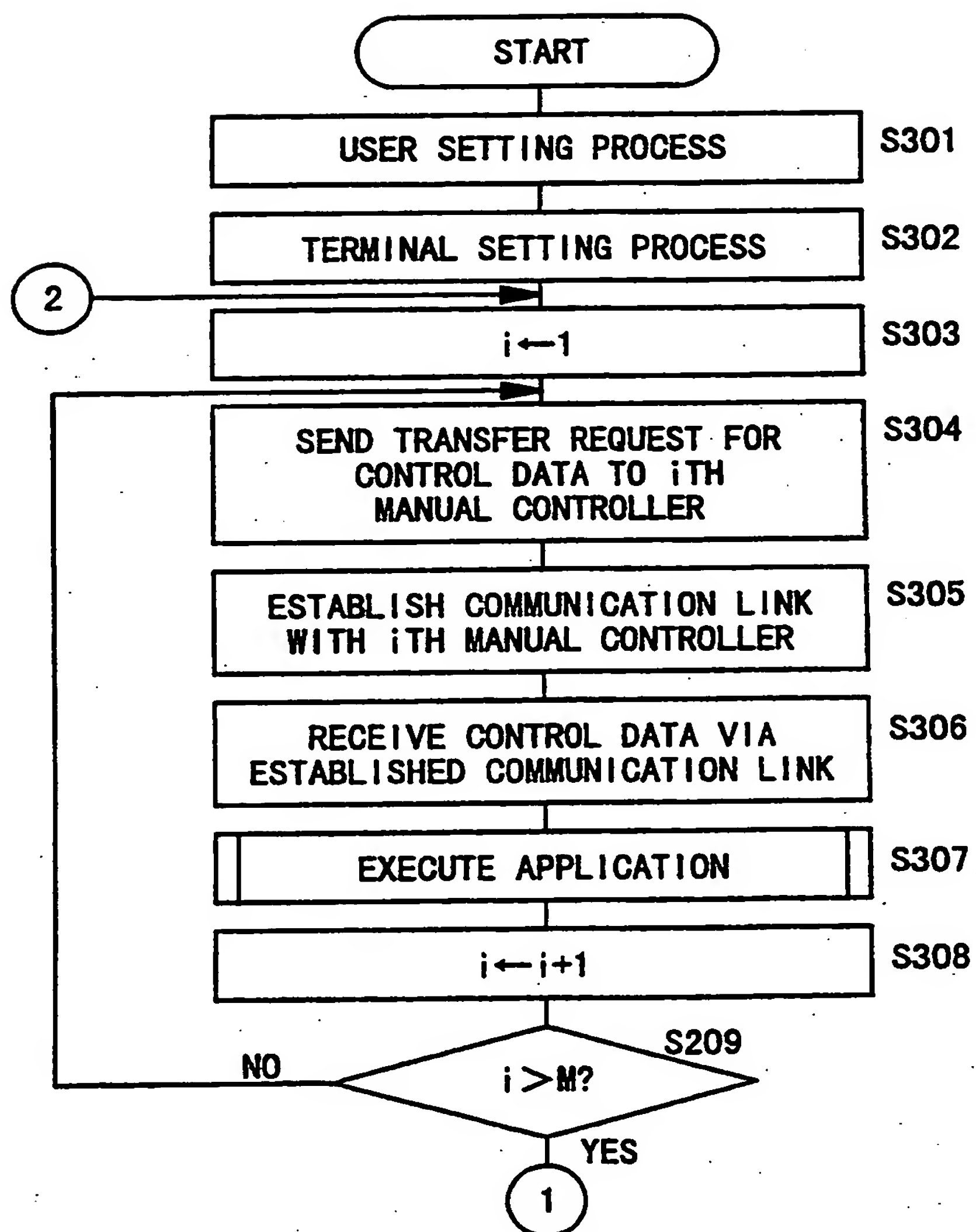


FIG. 34



35/43

FIG. 35



36/43

FIG. 36

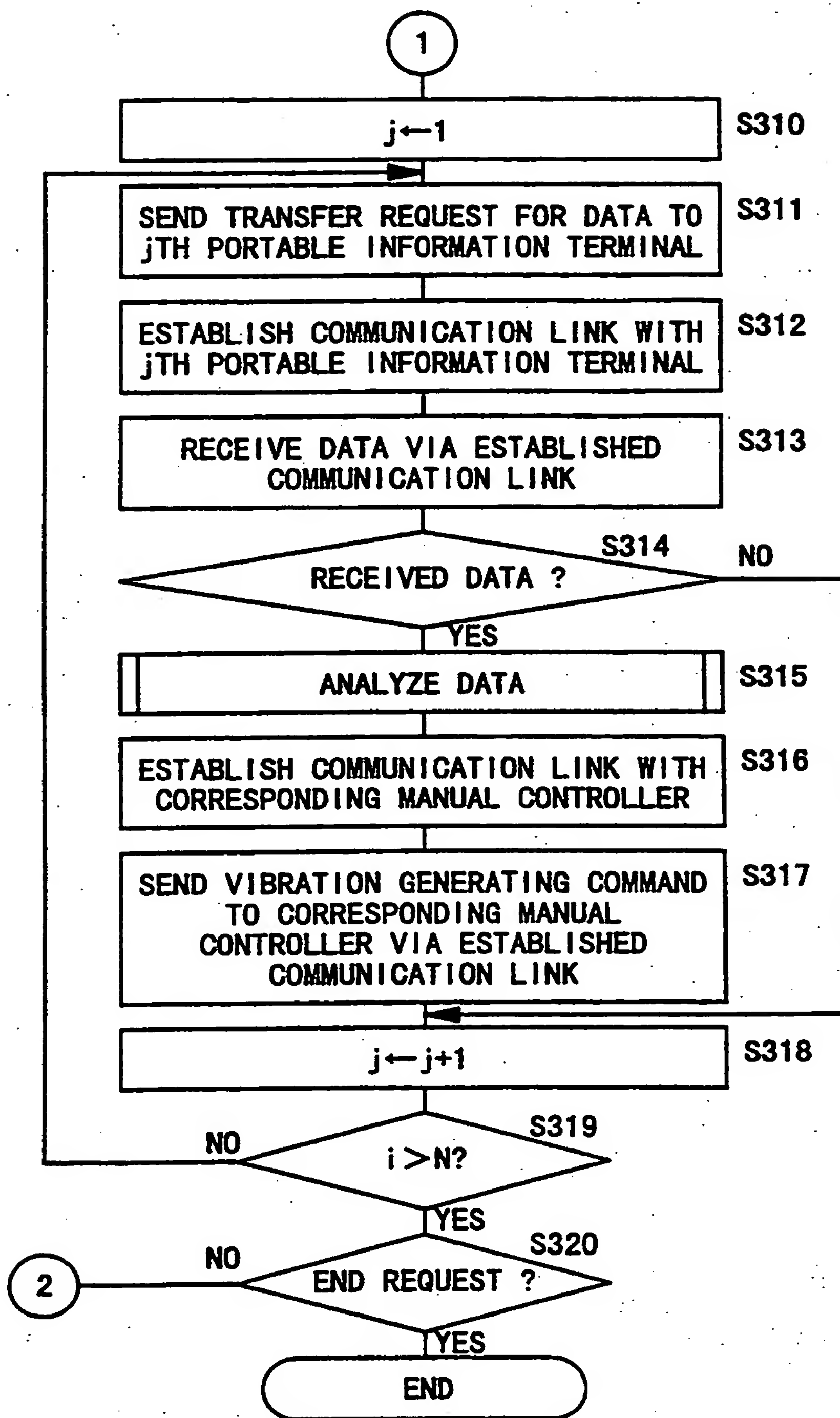


FIG. 37

VIBRATION INFORMATION TABLE

RECORD 1	CHARACTER STRING	VIBRATION INTENSITY	VIBRATION FREQUENCY
RECORD 2	CHARACTER STRING	VIBRATION INTENSITY	VIBRATION FREQUENCY
RECORD 3	CHARACTER STRING	VIBRATION INTENSITY	VIBRATION FREQUENCY
⋮	⋮		

38/43

FIG. 38

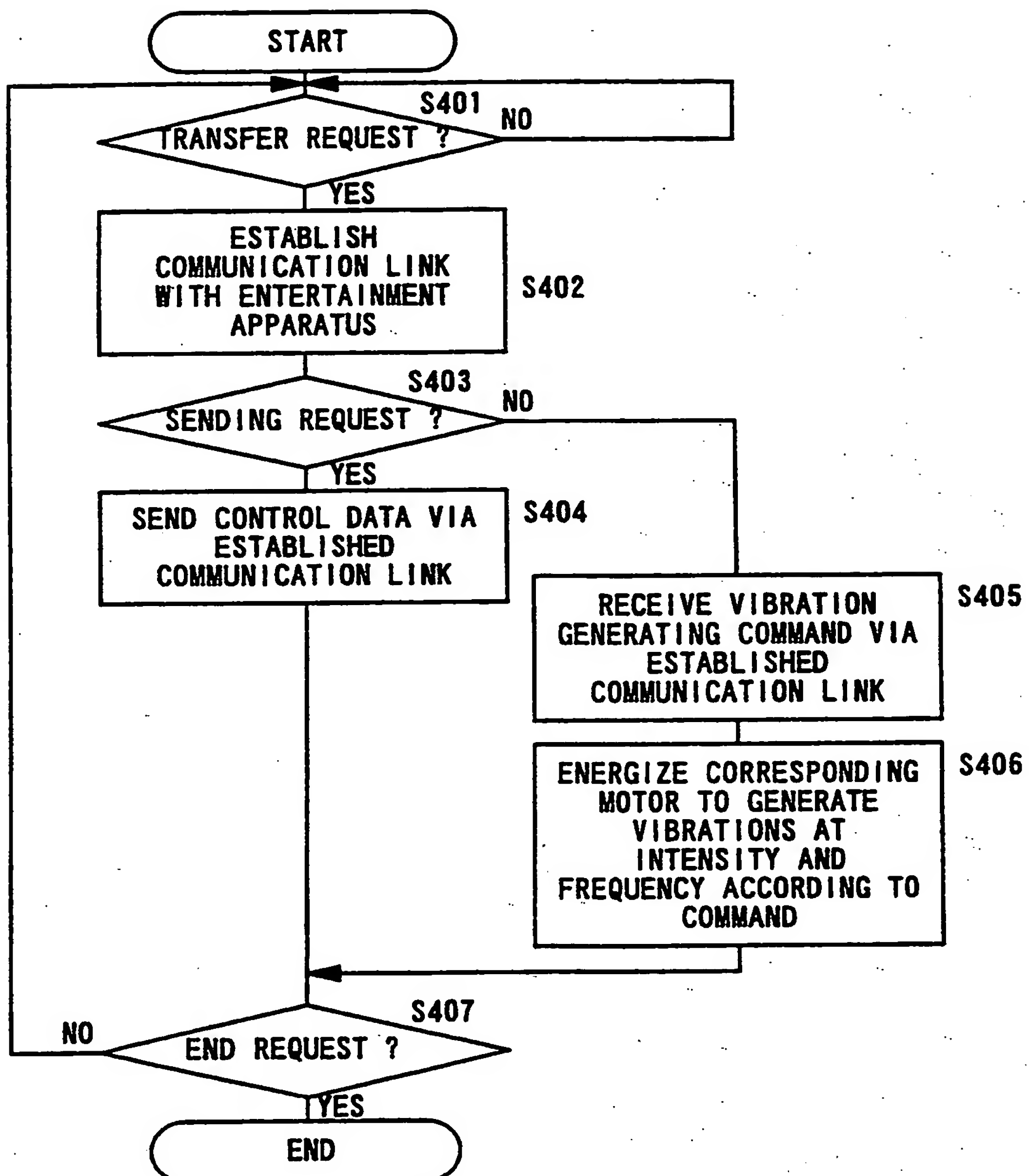
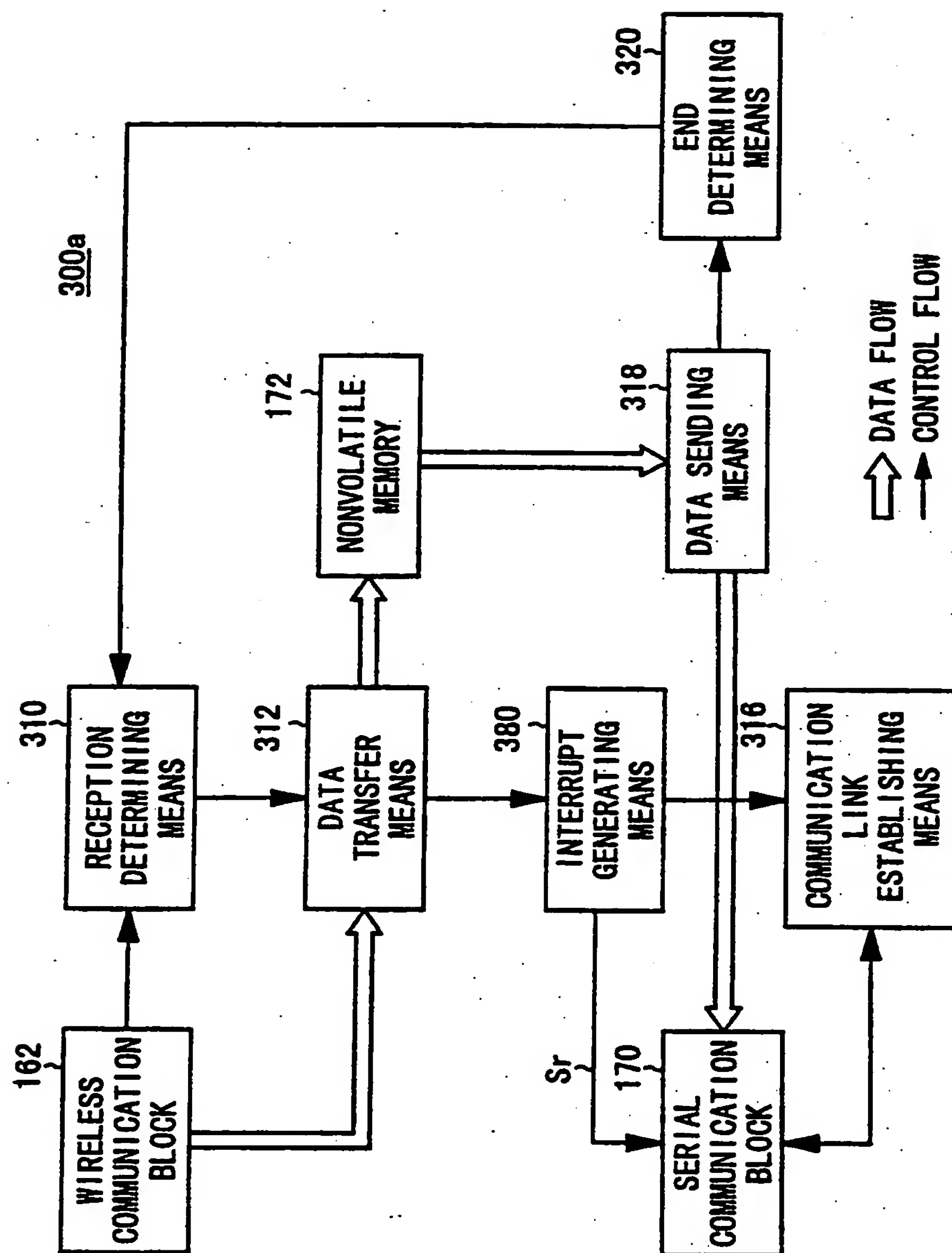
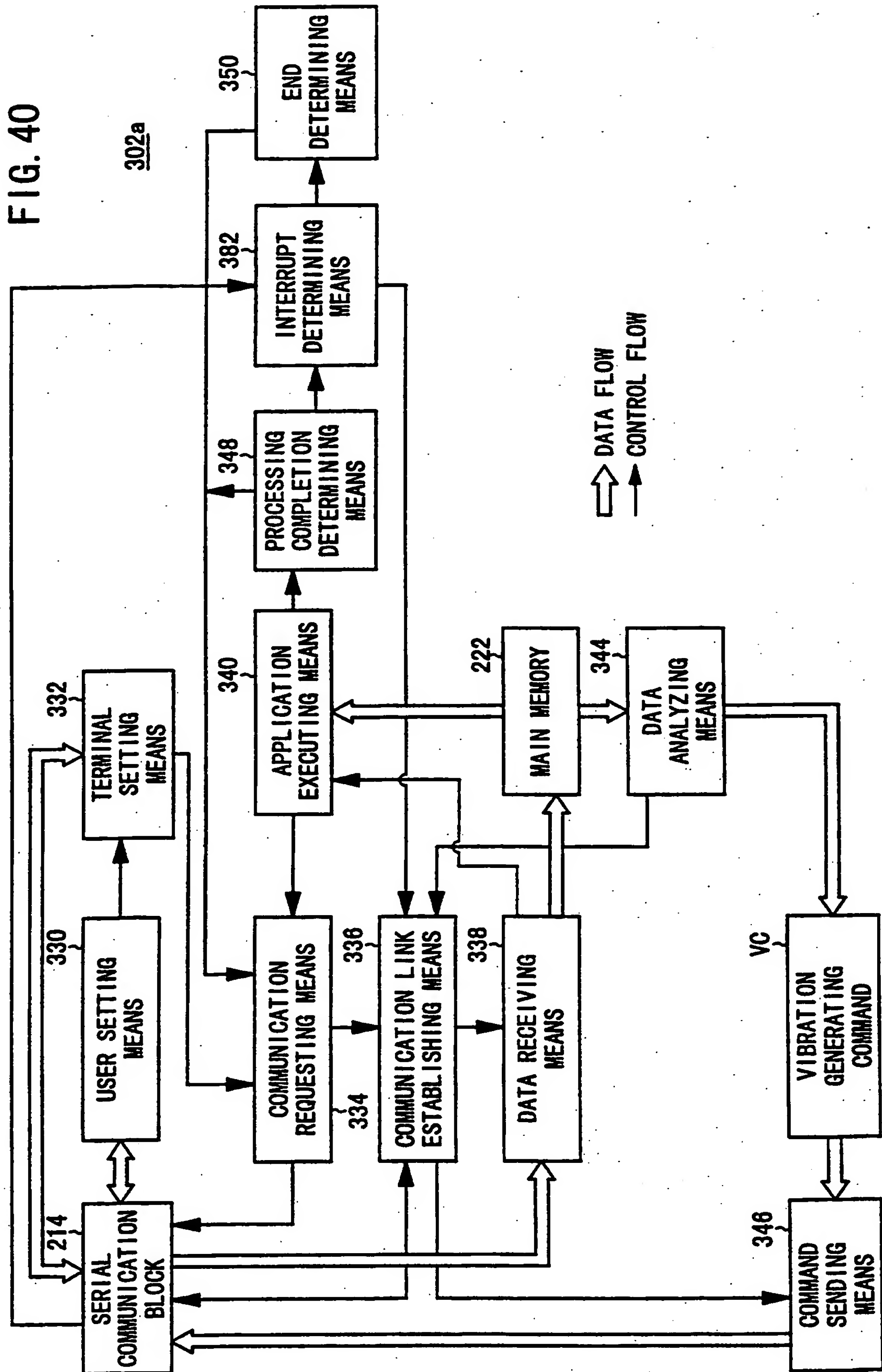


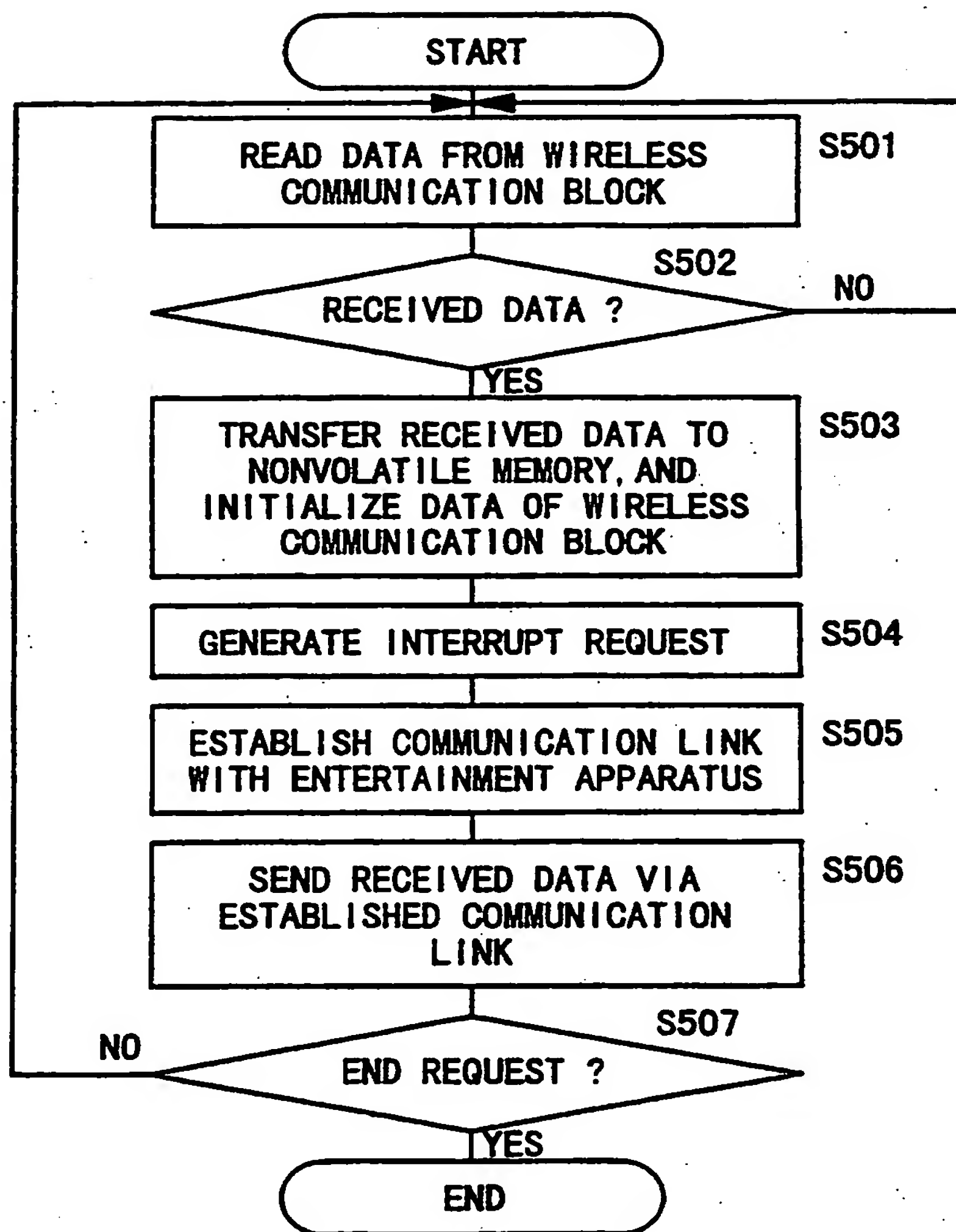
FIG. 39





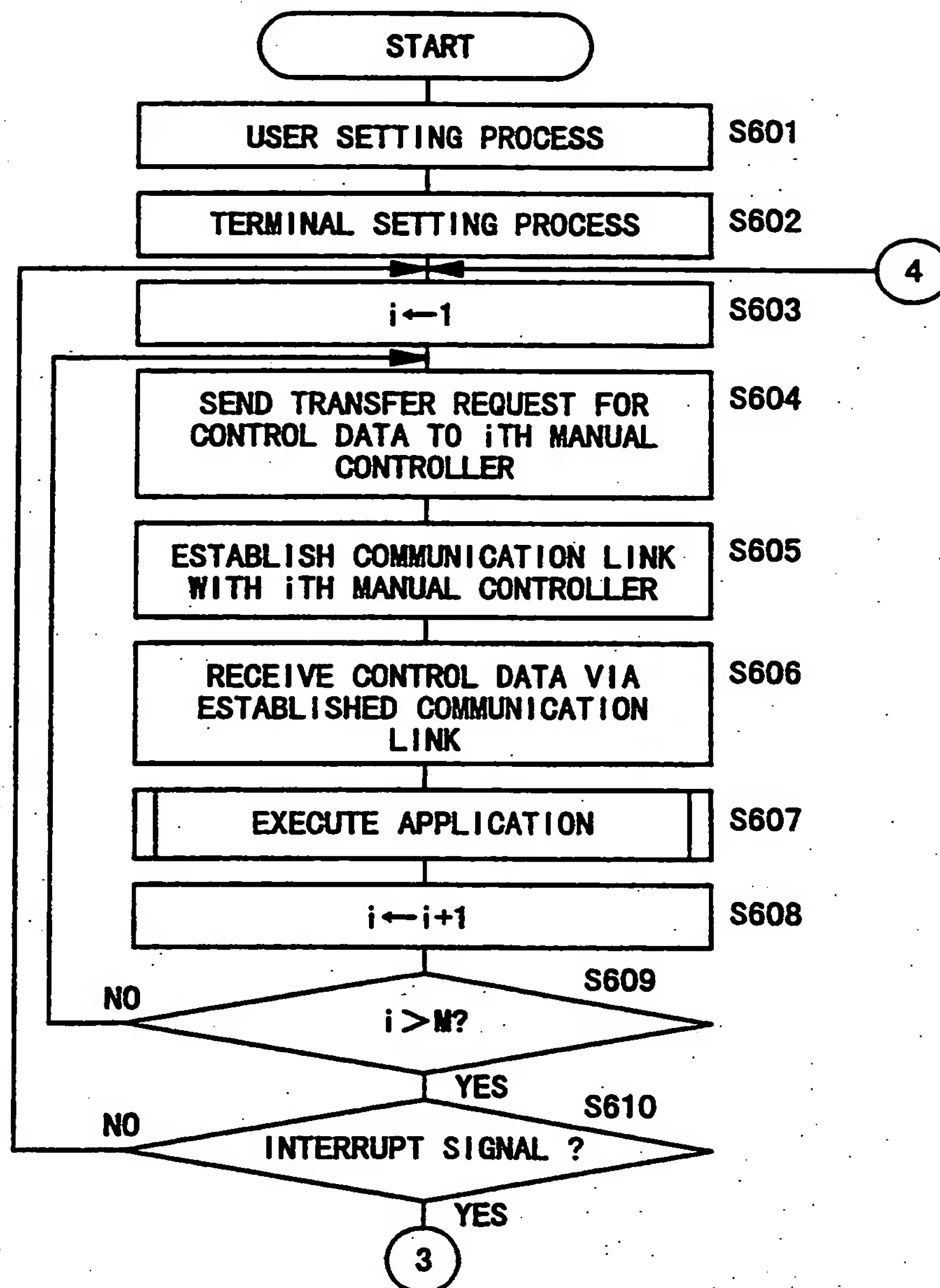
41/43

FIG. 41



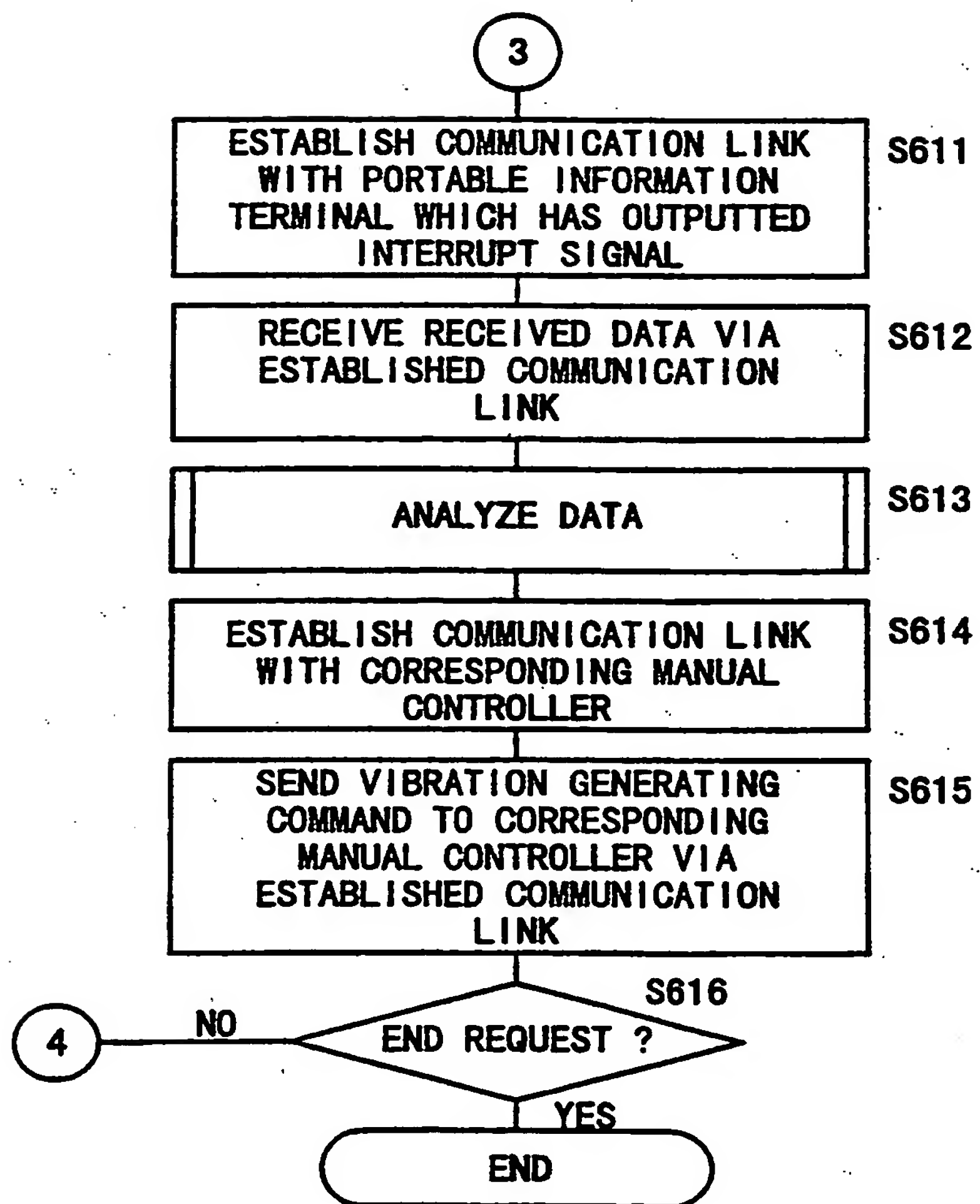
42/43

FIG. 42



43/43

FIG. 43



INTERNATIONAL SEARCH REPORT

Int. Application No.

PCT/JP 99/07400

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A63F13/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A63F G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 02, 26 February 1999 (1999-02-26) & JP 10 295932 A (KYUSHU HITACHI MAXELL LTD), 10 November 1998 (1998-11-10) abstract	1,2,9,10
A	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 02, 26 February 1999 (1999-02-26) & JP 10 295937 A (SONY COMPUTER ENTERTAINMENT:KK), 10 November 1998 (1998-11-10) abstract	1,9

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

22 March 2000

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP 99/07400

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5 591 104 A (ROBERTSON CHRISTOPHER D G ET AL) 7 January 1997 (1997-01-07) column 3, line 25 - line 31 column 3, line 56 - line 66	4,12
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Information on patent family members

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